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AN OUTBREAK OF PUERPERAL SEPSIS IN NEW YORK CITY*

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DURING the months of January and February, 1927, there occurred in the Sloane Hospital for Women, New York City, a series of cases of streptococcal puerperal infection which in their number, in their mode of incidence, and in their severity constituted a veritable epidemic. As an occurrence of this nature is now happily rare it seemed to us that a detailed account of the facts regarding it ought to be put on record, and an attempt made to examine the possible factors concerned in the initiation and spread of the disease.

During November and the early part of December, 1926, the puerperal morbidity rate as shown by the numbers of cases with temperatures over 100.4° F. was higher than normal. As a result of this a review of our technic was made. Two of the chief changes made at this time were the discontinuance of the use of lubricant soap solution in "ironing out" the vagina in primiparae, and the insistence on the wearing of masks by all those in attendance at deliveries. At the same time an order was given that vaginal examinations were to be reduced to a minimum. Details of the technic used will be found in the appendix.†

During the latter half of December and the first half of January, the morbidity rate was an average one and there were no serious cases of infection.

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†In the reprints.

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SEQUENCE OF EVENTS

On January 18, there was admitted to the hospital Mrs. L., a multipara, in labor. She gave a history of having had a severe cold for a week before. She had no temperature on admission. She had a normal labor, in the course of which one vaginal examination was made, and was delivered in the east operating room without laceration. On the third day her temperature rose to 100.8° F., and on the fourth day it reached 103° F., and from then till her death on the seventeenth day it ranged between this and 105° F. Lochial and blood cultures showed a streptococcus hemolyticus.

On the night of the same day, January 18, cesarean section was performed on Mrs. J., in the north operating room. This patient had been admitted on January 17 and had had feeble pains and ruptured membranes for twenty-four hours. One vaginal examination had been made. Her temperature remained below 100° F. until the fourth day, when it rose to 103.6° F. Thereafter it was sustained between 104° and 106° F. until the thirteenth day when she died. Hemolytic streptococci were recovered from her blood before death and from the peritoneal cavity after death. She also had a terminal pneumonia.

On January 19, cesarean section was performed in the north operating room on Mrs. N., who had had a trial labor of twenty hours and had membranes ruptured for two hours. One vaginal examination was made. Within twenty-four hours of operation her temperature rose to 104° F. She died on the fifth day. Upon opening the abdomen peritonitis was found and a hemolytic streptococcus recovered.

On January 20, Mrs. C., was delivered by cesarean section in the north operating room. No vaginal examination was made. She had a temperature of 99.6° F. when she was admitted to the hospital on January 14, but thereafter until she was operated she had a normal temperature and blood count. On the night of operation she had a very rapid pulse and the following day her temperature rose to 105.4° F. This temperature was maintained until she died on the third day. Signs of double basal pneumonia were present before death. No autopsy could be obtained and no blood cultures were taken. This was the first death to occur, and it was ascribed to postoperative pneumonia but in all likelihood it was a true septicemia.

On January 20, Mrs. F. was delivered by forceps in the private operating room. No vaginal examination was made prior to the operation. She ran a perfectly smooth course until the fifth day when she had a chill and her temperature reached 104.2° F. This temperature was maintained with slight remissions for ten days when it reached normal. For the next eight days it was remittent and on the twenty-third day a pelvic abscess was opened per vaginam. She was discharged well on the fortieth day. Blood cultures repeatedly taken were negative but lochial culture and cultures from the pus of the pelvic abscess showed a hemolytic streptococcus.

On January 20, Mrs. E. had a normal delivery in the east operating room. She had had fever for three days before admission when her temperature was 99.4° F. For eight days after delivery her temperature was not above 100° F. except on the fourth day when it reached 102.8° F. On the ninth day it rose to 104° F., and remained there for two days after which it gradually dropped to normal. She was discharged well on the twenty-sixth day. A hemolytic streptococcus was recovered from her cervix on the twelfth day and from a small abscess in the buttock, the site of a quinine injection on the eighteenth day. Blood culture was persistently negative.

On January 14, Mrs. B. was admitted to a private floor. She had had a severe cold with a temperature of 103° F. at home. On admission the temperature

was normal but on two occasions, on January 18 and January 23, it reached 99° F. She was delivered in the private operating room on January 24 after a normal labor in the course of which the only examination or interference was the artificial rupture of the membranes at the vulva. Within thirty-six hours her temperature reached 104.6° F. and in the course of the second day it rose to 107.6°F. She died on the third day. Hemolytic streptococci were found in the blood during life, and a partial autopsy showed peritonitis with an abundant growth of streptococcus hemolyticus.

On January 26, Mrs. P. was admitted and had a normal delivery with a first degree laceration in the east operating room. One vaginal examination was made. On the third day the temperature rose to 103.8° F. and varied between this and 105.6° F. until the seventh day after which it fell to below 103° F. For the next thirty days it fluctuated between 99° and 103° F. Thereafter it was normal and she was discharged well on the fifty-first day. Repeated blood cultures were negative but vaginal culture showed a streptococcus hemolyticus.

On January 27, Mrs. D. had a normal delivery in the east operating room. One vaginal examination was made. She had a laceration which was repaired. Temperature rose to 104° F. on the eighth day with a chill. It gradually fell to normal on the tenth day. Blood culture was negative. Vaginal culture showed streptococcus hemolyticus.

On January 29, Mrs. T. had a normal delivery with a first degree laceration in the east operating room. Three vaginal examinations had been made. She had a temperature of 99.4° F. during labor. On the third day temperature rose to 104.6° F.; it was sustained with slight remissions until she died on the ninth day. Vaginal culture and blood culture showed a streptococcus hemolyticus.

On the same day, January 29, Mrs. W., had a normal delivery in the east operating room. One vaginal examination was made. Her temperature during delivery was 99° F. On the third day it rose to 103.2° F. It reached 106.4° F. on the fourth day and thereafter quickly fell to 102° F., and from there fell by lysis to normal on the fifteenth day. She was discharged well on the eighteenth day. Blood cultures throughout were negative. Vaginal cultures showed a streptococcus hemolyticus.

On January 20, Mrs. F. had a normal delivery in the east operating room. One vaginal examination was made on account of some bleeding at the beginning of labor. She was a diabetic. Temperature remained normal until the ninth day when it suddenly rose to 105° F. with a chill. It was sustained at this level for two days and gradually came down, by lysis, to normal on the thirteenth day. She was discharged well on the twenty-third day. The lochia showed a streptococcus hemolyticus which was still present on discharge. Blood culture was negative.

On January 31, Mrs. McG. had a normal delivery in the east operating room. One vaginal examination was made. Temperature remained normal to the fourth day when it rose to 101° F. It reached 104.4° F. on the fifth day. She died on the twentieth day. Blood cultures were positive for streptococcus hemolyticus and vaginal cultures showed the same organism.

On February 2, Mrs. R. was delivered in the east operating room by low forceps after manual rotation of the head. No vaginal examination was made before the forceps application. Temperature remained normal to the third day when it rose to 103° F. Her temperature was sustained about this level until the thirtieth day when it gradually dropped by lysis, and the patient was discharged well on the fifty-first day. A pelvic cellulitis developed but did not suppurate. Vaginal culture showed streptococcus hemolyticus but blood cultures were persistently negative.

On February 2, Mrs. C. was delivered in the east operating room by forceps after rotation of head. She had a temperature of 101° F. at the time of delivery; within a few hours it reached 104° F. and on the second day it rose to 105° F. with a chill. Thereafter it gradually fell and she was discharged on the fifteenth day. A hemolytic streptococcus was cultured from the vagina but none from the blood.

On February 4, Mrs. L. was delivered in the east operating room. She had a severe cold at the time of delivery and had a temperature of 99° F. On the second day temperature rose to 103.8° F. with a chill. It was sustained for two days at this level; gradually fell to 100° F. which it reached on the eleventh day. It was thereafter normal until her discharge on the twenty-second day. She had an inflamed patch on the right tonsil. On the fifteenth day some induration could be felt in both broad ligaments. This had entirely disappeared on her discharge. Vaginal and blood cultures were negative for streptococcus. Throat culture showed a nonhemolytic streptococcus.

On February 5, Mrs. B. was delivered in the east operating room. She had a normal delivery and sustained a second degree laceration. No vaginal examination was made. On the fifth day temperature rose to 103.4° F. It gradually dropped to normal on the twelfth day. She was discharged on the seventeenth day. Blood culture negative. Vaginal culture showed streptococcus hemolyticus.

On February 7, Mrs. M. had a normal delivery in the east operating room. One vaginal examination was made. Cultures from the vagina on the second day postpartum were posltive for hemolytic streptococcus but she had no temperature until the fifth day when it rose to 105° F. with a chill. She ran a long course and died on the seventy-fifth day. During the course of her illness localized abscesses formed in the peritoneum; two of these were opened. At no time had she a positive blood culture.

On February 9, Mrs. S. had a normal delivery in the special delivery room on the sixth floor. One vaginal examination was made. On the fourth day her temperature rose to 102° F. at which level it remained for three days and then gradually fell to normal. She was discharged well on the sixteenth day. Vaginal culture showed streptococcus hemolyticus. Blood cultures were negative.

On February 9, Mrs. S. was delivered by cesarean section in the north operating room. No vaginal examination made. Temperature remained below 100° F. until the fifth day when it suddenly rose to 105° F. It remained between 101° and 104° F. until the tenth day when it fell by lysis to normal; it was persistently normal after the twentieth day. She was discharged well on the twenty-fourth day. The abdominal wound healed by first intention. Blood culture was negative throughout. Lochial culture showed a streptococcus hemolyticus.

On February 10, Mrs. B. was delivered by forceps in the private operating room. No vaginal examination before forceps application. She had had a hemolytic streptococcal infection of the nose a year before, and there was a recurrence of throat trouble with a temperature of 108° F. before admission. On the third day postpartum the temperature reached 104° F.; it reached this level again on the fourth day, fell by lysis and was persistently below 100° F. until the twenty-sixth day when it reached 102° F. and then went to 105.2° F. on the thirtieth day. At this time some induration was found in the cellular tissue of the pelvis. She ultimately made a complete recovery and was discharged on the fifty-sixth day. Blood culture throughout was negative. Vaginal culture showed the streptococcus hemolyticus.

On February 10, Mrs. C. had a normal delivery with a second degree laceration in the special delivery room on the sixth floor. On the fourth day temperature

rose to 102° F., it was sustained at this level for three days and fell by lysis to normal. Patient was discharged well on the thirteenth day. Vaginal culture showed streptococcus hemolyticus. Blood culture was negative.

Mrs. C. had a normal delivery on February 12 in the special delivery room on the sixth floor north. On the second day temperature rose to 103° F. It was remittent between 100° and 105° F. until the forty-first day. An inflammatory mass developed on the right side of the pelvis and in front of the uterus. This was drained on the forty-first day. This temperature gradually came down reaching normal on the forty-ninth day. Patient was discharged on the fifty-seventh day when there was still some thickening to be felt on the right side. Blood cultures and vaginal cultures were negative for streptococcus hemolyticus.

On February 13, Mrs. W. was delivered by low forceps in the private operating room. On the second day she had a chill and her temperature rose to 103° F. It returned to normal on the fourth day and did not rise again. Blood culture was negative; vaginal culture showed a hemolytic streptococcus.

On February 14 admission of patients to the wards of the hospital was stopped. A private patient, Mrs. S., admitted on that day, was delivered by forceps in the private operating room on February 18. Her temperature remained normal until the fourth day when it rose to 104° F. with a chill. It remained at this level for the next three days when it fell suddenly reaching normal on the eighth day where it remained until the eleventh day when it rose, suddenly, to 106° F. with a chill. By the twelfth day it had again reached normal and so remained until her discharge on the twentieth day. Repeated blood cultures were negative. Vaginal cultures showed a streptococcus hemolyticus.

The hospital was reopened on February 24.

On March 14, Mrs. F. was delivered by forceps in the private operating room. On the third day her temperature rose suddenly to 104° F. with a chill. She became very restless and soon was in a condition of acute mania, so that on the fifth day she was transferred to Bellevue Hospital. Streptococcus hemolyticus was cultured from blood obtained on the fourth day. She died in Bellevue on the seventeenth day. No autopsy was done.

SUMMARY

During the period January 16 to February 14 one hundred and sixty-three patients in all were delivered. Of these twenty-four, or approximately fifteen per cent, showed evidence of streptococcal infection. One case developed after February 14 and died. The number of deaths in the twenty-five cases was nine, a mortality of thirty-six per cent. During the same time twelve other patients had morbid puerperia with temperatures of 100.4° F. or over. In none of these were streptococci demonstrated and in none was there gross evidence of uterine infection. Five of them had evidence of pyelitis and all made a rapid recovery. Two patients with hemolytic streptococci in the vagina had no temperature.

The methods of delivery in the twenty-four infected cases were as follows:

Normal	13
Forceps	6
Cesarean section	4
Version in twins	1

Vaginal examinations were made as follows:

Normal cases	5 ____ no examination
	7 ____ one examination
	1 ____ three examinations
Forceps cases	3 ____ no examination
	3 ____ one examination
Cesarean sections	2 ____ no examination
	2 ____ one examination

In seven of the whole series, therefore, no vaginal manipulation of any kind was carried out.

Streptococcal Infections in Infants.—Only one infant had an infection during this period. It was the child of an infected patient, Mrs. P., and it was separated from its mother when it was four days old. It developed a general erysipelas on the sixteenth day and died.

Streptococcal Infections in the Staff.—Twenty nurses and two attending surgeons had hemolytic streptococci in the throat or nose during the period of the epidemic. Four nurses had tonsillitis.

On January 31 a nurse who was nursing an infected patient pricked her finger with a safety pin. In twenty-four hours the arm became painful, the temperature rose and she became very ill. She was transferred to the Presbyterian Hospital where later the arm and axilla were incised. A hemolytic streptococcus was obtained from the pus. Blood cultures were negative. She recovered.

On February 14 at 6:30 P.M. a nurse, Miss S., complained of feeling chilly. She was taken off duty and at 7:30 P.M. her temperature was 101° F. Her only complaint was pain in the back and legs. The following afternoon she complained of abdominal distress which soon became acute pain and her temperature rose to 104° F. She was transferred to St. Luke's Hospital. On the evening of February 16 the abdomen was opened. A general peritonitis was found with no primary lesion demonstrable. A hemolytic streptococcus was recovered from the peritoneal fluid. She ultimately made a good recovery. She had had no sore throat, but there was swelling of the glands of the neck. She had a negative throat and nose culture. She had not been in contact with infected cases in the wards, but on February 10 had assisted at the delivery of Mrs. B., who subsequently developed infection.

The sum total of the epidemic, therefore, includes twenty-five puerperal infections with nine deaths, one fatal case of erysipelas in an infant, one streptococcal cellulitis in a nurse, and one primary peritonitis in a nurse.

EPIDEMIOLOGY

Like some other epidemics the present one got under way and was in full swing before we realized what was happening. It is only on looking back and reviewing the various occurrences that we can piece together the story. In the three days, January 18, 19, and 20, seventeen patients were delivered in the hospital. Six of them developed

a virulent streptococcal infection and four of them died. Of these six patients three were delivered by cesarean section in the north operating room on the seventh floor; two had normal deliveries in the east operating room on the ground floor; and one was a forceps delivery in the private operating room on the third floor. These six patients before and after delivery were on different floors of the hospital, two of them in private rooms on the second floor, two in separate public wards on the third floor, two in separate wards on the fourth floor before delivery, and in the same ward after delivery. The three cesarean sections were performed by different operators but the operating room staff was the same in all cases. In the same operating room and with the same staff seven gynecologic laparotomies were performed between January 18 and January 21 and on the latter date another cesarean section. All of these patients had a perfectly normal convalescence. The routine gynecologic operating of the hospital was carried on in this operating room until February 9 with absolutely no untoward results. There were no wound infections or other evidences of sepsis in these patients.

The supplies for the north operating room, where the cesarean sections were done, were sterilized in the sterilizing room attached to it. The supplies for the east operating room and for the private operating room were sterilized in the east operating room. All sterilizers in the hospital are under clock control and are checked once a week by culture. Examination of dressings, sponges, gloves, etc., subsequent to the outbreak of the epidemic proved them to be sterile.

The sterile water supply is separate for each operating room. A check-up of this at a later date showed absolute sterility in the hot water supply throughout but from one of the cold water tanks a few organisms were obtained but no streptococci.

The senior resident assisted at all three cesarean sections and delivered the one patient in the private operating room, but he was not present at the two deliveries in the east operating room.

The attending surgeon who operated upon one of the cesarean sections had examined one of the other two vaginally two days before, but he was not present at the third.

The same intern delivered the two patients in the east operating room but took no part in the cesarean sections or in the delivery of the patient in the private operating room.

There is an interchange of nursing staff between the east operating room and the private operating room, but the north operating room staff is quite separate.

It, therefore, seems impossible at this stage to find a common factor applicable to all the cases.

The first likely clue we had to follow was that the next six patients to develop infection were all delivered at night. The night intern delivered five of the patients in the east operating room and gave the

anesthetic to the sixth in the private operating room. He had also delivered two of the patients among the first six infected. The night operating room supervisor assisted at all of them. Nose and throat cultures from the intern and the supervisor showed the presence of a streptococcus and both were taken off duty on January 31; that was thirteen days after the delivery of the first patient to show infection. The intern was sent on a vacation and did not return, as his term of service ended shortly after, so that no further cultures could be obtained from him. This was unfortunate as his organism eventually proved to be a streptococcus viridans. The organism from the nurse also was found by Dr. Meleney to be of a different strain from that of the infected patients.

Cultures from the throat and nose of the attending surgeon who performed the first, and examined the second fatal cesarean section, and later delivered the patient in the private operating room, who developed infection, were positive for hemolytic streptococci. Subsequent detailed examination of these cultures by Dr. Meleney showed the organism to be of a different strain from that of the infected patients.

All that we had to go on, therefore, at this stage was that certain individuals in the hospital were harboring streptococci in the nose and throat. These individuals were, therefore, excluded from contact with patients.

In spite of the change of the night staff, and the exclusion of others who were carriers, as they were found, three patients delivered in the east operating room during the following week became infected. This operating room was, therefore, closed and all deliveries were conducted in the clinic room on the sixth floor, one of the gynecologic wards being used as a first stage room. Three patients delivered there developed infections, as did also one delivered in the private operating room, and one delivered by cesarean section in the north operating room. We then seemed to be at the end of our resources and stopped admission of patients to the hospital on February 14.

The hospital remained closed for ten days and on February 24 was reopened. The first case admitted was a patient in labor who subsequently was found to have a gonococcal infection. She had a febrile puerperium but no streptococci were found. She gave us some anxiety until we were certain of the diagnosis. No other patient had a febrile puerperium until on March 17, Mrs. F., delivered by forceps in the private operating room on March 14, had a sudden rise of temperature with a chill. Streptococci were recovered from her blood on the fourth day of her illness. She developed acute mania and was removed to Bellevue Hospital where she died on the seventeenth day. Since that time there have been no streptococcal puerperal infections in the hospital.

Early in the epidemic it was noted that certain of the infected patients had had a temperature before delivery and it was thought possible that they might be harboring streptococci in some part of the body and that invasion of the uterus and generalized spread occurred in the early puerperium. Twelve of the twenty-four patients had a temperature of 99° F. or over before or during parturition; three of them had severe colds before their admission to the hospital and stated that they thought they had had fever. One patient was known to have had a temperature of 103° F. the day before she entered the hospital, on January 14. She was in a private room in the hospital for ten days before delivery took place. During this time her temperature rose to 99° F. on two occasions. She died on the third day following delivery of streptococcal infection.

In those early cases bacteriologic examination of the nose and throat was not made. In a large number of patients examined subsequently only one was found to have hemolytic streptococci in the throat. This, together with Dr. Meleney's later work which showed that the streptococci recovered from the fatal and severe cases were nearly of one strain, rendered it unlikely that the individual patient brought in her own organism.

While the epidemic was in progress, we heard from time to time of infections occurring in other hospitals both obstetric and surgical and we wondered whether 1927 might be a "streptococcal year" analogous to an "influenza year." Several aural surgeons informed us that during the early part of 1927 there was an unusual number of severe streptococcal sinus and mastoid infections in New York. With the hope of being able to throw some light on this a questionnaire was sent this autumn to a number of obstetric hospitals throughout the country asking if there had been noted any increased incidence or increased severity of streptococcal infections during the early months of 1927. Twenty-four hospitals replied and of these seven stated that the morbidity and mortality rates from streptococcal infections were distinctly higher than the average; seventeen stated that there had been no increase. Five of the seven hospitals which had noted an increase were in the area of greater New York or its immediate vicinity, one was in Baltimore, one in Philadelphia. One of the replies stated that there had been a thirty-three per cent increase over the average of streptococcal infections but no deaths. In one hospital there had been three deaths and in one six deaths. Five of the hospitals stated that there had been an increased incidence of streptococcal infection on the surgical services attached to or affiliated with them. In three there had been a noteworthy incidence of streptococcal infection among the members of the staff.

It would thus appear that during the early months of 1927 there was an increased incidence of streptococcal infection in the eastern part

of the country. Whether that increased incidence was due to the greater prevalence of the organisms, their greater virulence, or a general increase in susceptibility cannot be said.

It is interesting to note that there was an increased prevalence of scarlet fever in the United States during the later months of 1926 and the early months of 1927.*

Dafoe† reported an epidemic of puerperal hemolytic streptococcal infection with eight deaths in the months of January and February, 1924, in Toronto General Hospital. He states that these cases "were coincident with other cases of puerperal sepsis of a similar type in various other hospitals and in private practice. At the same time there was a marked prevalence of sore throats, sinus infections, and middle ear trouble throughout the city." In the investigation of this epidemic hemolytic streptococci were found in the noses or throats of the two house surgeons, in nine out of twenty-five students, and in fifteen per cent of the nurses.

The streptococcus recovered from the Sloane patients was an extremely virulent one. As Dr. Meleney will show in his paper, it was so constant in type in the different cases that it must have come from a common source. How it acquired its virulence or how it was first introduced we have failed to prove. The fact that it was recovered from the vagina of every infected patient seems to be proof that it entered the body by this route. In none of the patients examined in the latter part of the epidemic or in the three months following it were streptococci found in the vagina prior to delivery. The inference must be that the organisms got into the vagina at the time of labor or in the early puerperium. As the only place in the hospital where hemolytic streptococci were found was the throat or nose of certain doctors and nurses the inference is that the organisms were spread to the cases in this way.

MEASURES TAKEN TO CHECK THE EPIDEMIC

As soon as it became evident that infection was present in the hospital careful check was made on all technic. Vaginal examinations were forbidden except when absolutely necessary and were then made only by an attending or the senior resident after complete iodine preparation of the vulva and vagina and full sterile draping as for delivery. We had not used mercurochrome as a routine in the hospital and considered it safer to adhere to a technic with which we were all familiar and which had proved satisfactory in the past. (See appendix.) As previously mentioned bacteriologic examination of all dressings, gloves, and sterile water was carried out. Masks which had previously been worn had, in many cases, not fully covered the nose. On January 28 we asked Dr. Meleney to come to our assistance. He pointed out the importance of masking the nose completely as well as the mouth. From that date complete masking was carried out. The masks were worn not only in the delivery room but in the first and second stage rooms by all doctors and nurses. On February 5 every member of the attending, resident, intern, nursing, and domestic staff had throat and nose cultures taken and these were repeated at weekly intervals. No one with a positive culture of streptococcus

*Public Health Reports, xliii, No. 3.
†Edin. Med. Jour., xxxii.

hemolyticus was allowed to come in contact with a patient before, during, or after delivery. A certain number of nurses with positive cultures were assigned to nursing the already septic patients. All others with positive cultures were excluded from the hospital. Every nurse was masked when doing postpartum dressings. The night intern who had a positive culture was sent on a vacation. The two attending surgeons with positive cultures did not visit the general labor room or public wards. They did for a time visit their private patients but were completely masked when they did so. Students were excluded from the hospital.

After the first evidence of infection in the patients delivered in the north, east, and private operating rooms the walls and floors of these were thoroughly washed with soap and water and chloride of lime. As the cases still continued in the east operating room it was closed on February seventh, and thereafter all patients were delivered in the gynecologic examining room on the sixth floor north, one of the gynecologic wards being used as a first stage room. Of the patients delivered there during the next week three developed infection. It was then decided to stop all admissions to the hospital. This was done on February 14 and no patients were admitted from then until February 24. Meanwhile the operating rooms had been fumigated with formalin and completely repainted. The entire ward side of the hospital, including halls, stairways, and pantries, was painted. Every mattress and pillow in the hospital was sterilized and remade, new ticking being used throughout. All blankets were washed. These measures were evidently effective for after the reopening on February 24 no other cases occurred except the isolated one on March 14. The Superintendent has computed that, apart from the loss of revenue due to cancelled reservations, the cost of the epidemic to the hospital was over six thousand dollars.

For three months after the reopening of the hospital, cultures were taken from the vagina of every patient on admission, at the beginning of labor, at the end of labor, and on the second, fourth, and seventh days postpartum. During this time no hemolytic streptococci were found.

The precautions regarding vaginal examinations and the masking of nose and mouth by every one in the first and second stage rooms as well as in the delivery room have been adhered to. Every nurse before she enters the hospital must bring from her school a report that cultures have been taken from the nose and throat and that they are negative for hemolytic streptococci. Weekly cultures of the Staff are being taken during the winter months. It is interesting to note that so far this winter not a single hemolytic streptococcus carrier has been found.

ISOLATION OF INFECTED CASES

In the Sloane Hospital there is no isolation wing. Two of the wards at the end of the corridor on the fourth floor are used as septic rooms. They have their own utility room.

It was a rule of the hospital that when a patient developed a temperature of 100.4° F. or over she was removed to one of these wards. This rule was adhered to before and during the epidemic. As the cases increased other wards on the same floor were used for the infected cases. These were shut off from the rest of the floor by a door. After February first all attending surgeons and interns were excluded from this part of the floor, the Director and Obstetric Resident being the only doctors who visited or handled the patients, and they did not visit other wards or take part in the delivery of patients. Gowns, caps, and masks were worn by them while on the floor. Nurses were put under isolation rules and were made to change their dresses before leaving the floor. All bed linen and dressings were soaked in strong lysol solution before being sent from the wards to the laundry. All dishes were disinfected immediately after use. In the later part

of the epidemic cultures were made from the vagina of every patient before delivery, after delivery, and on the second, fourth, and seventh days of the puerperium. In three patients hemolytic streptococci were found on the first postpartum examination and these individuals were at once isolated. One developed infection on the fifth day and died; the other two showed no symptoms.

The experience we have gone through emphasizes the necessity for a self-contained isolation unit in every maternity hospital. Our improvised arrangements proved to be ineffective and, looking back now, we regret that we did not close the hospital earlier than we did.

CLINICAL OBSERVATIONS

Under this heading there will be discussed the mode of incidence of the disease, its general course, the blood picture, the occurrence of streptococci in the blood and in the lochia, and the terminal results.

Mode of Incidence.—The time after delivery at which the first rise of temperature occurred is of interest. In the great majority of cases this rise occurred suddenly to 103° F. or over and was accompanied by a definite chill. In two cases the rise occurred within twenty-four hours; in one, it was on the eighth day; and in one, on the ninth day postpartum. In the majority of cases the rise took place on the third, fourth, or fifth day, the average time for twenty-four cases being 3.75 days postpartum. This rather late appearance of temperature and especially the occurrence of the two on the eighth and ninth days made us think at one time that the infection might be getting into the patients not at the time of delivery but in the puerperal period, and this led to a very thorough investigation of the bedding and dressings which Dr. Meleney will mention in his paper. It may be said now that no streptococci were found anywhere in the environs of puerperal patients in normal wards. We have, therefore, no proof that infection occurred after delivery.

After the initial rise, the temperature was usually maintained with slight remissions for several days, and in those who recovered, the remissions became greater and a gradual fall took place while in the fatal cases the remissions became smaller with a gradual rise until death occurred. The highest temperature recorded was 107.6° F. on the second day postpartum. The patient died within twelve hours. The temperature curve was markedly influenced by serum and quinine treatment. In the patients who recovered there was a drop of several degrees after intravenous serum and after intramuscular quinine administration. The drop was not so constant or so great after blood transfusion.

At the time of the rise of temperature the pulse also rose and the two curves as a rule ran together. In the first patient who died after cesarean section the first indication of anything wrong was a pulse of 140 on the night of operation so that an internal hemorrhage was suspected. Her temperature did not rise until twelve hours later. In all the others, temperature and pulse rose at the same time.

Abdominal distention was a prominent symptom in fourteen of the cases. Of these, seven were fatal and seven nonfatal. Diarrhea was noted in three fatal cases and in four that recovered.

In six of the fatal cases signs of consolidation and friction at the bases of the lungs appeared. It was most constant and most marked on the left side. It usually appeared just about the time at which the first positive blood culture was obtained and, taken along with this, we came to regard it as a bad prognostic sign. In such cases as came to autopsy the bases of the lungs showed fibrinous pleurisy, sometimes with fluid, and a lymphatic interstitial pneumonia (see autopsy reports).

As a general rule the involution of the uterus was delayed, and there was never more than slight uterine tenderness.

In eight cases, all of which recovered, there was inflammatory exudate in the pelvis and in two of these, abscesses formed. In no case was there an excessively foul lochia but in eleven it was noted as fetid or slightly fetid.

Blood Picture.—In Table I a summary and average of all the blood counts in the twenty-four cases is given. The average leucocyte count at the beginning of the infection was 19,800 with 84 per cent polymorphonuclear, and 71.5 per cent hemoglobin. At the height of the disease the corresponding figures are 25,000; 88 per cent; and 57 per cent. The highest leucocyte count was 41,400 with 91 per cent polymorphonuclears. This patient was a diabetic whose illness began on the ninth day after delivery and she recovered. In only one case did the leucocyte count never reach 10,000. This was Mrs. B., who died on the third day after delivery. Her highest count was 9,800 with 86 per cent polymorphonuclears.

TABLE I. SUMMARY OF BLOOD FINDINGS IN 24 CASES OF STREPTOCOCCAL PUERPERAL INFECTION

		LEUCOCYTES	POLYMORPHONUCLEARS	HEMOGLOBIN
First blood examination after rise of temperature	Average	19,800	84%	71.5%
	Maximum	41,000	91%	78.0%
	Minimum	9,800	86%	54.0%
Blood examination at height of infection	Average	25,000	88%	57.0%

In four patients there was a sudden drop in the number of leucocytes in the course of the disease, three of these patients died and one recovered.

One of them, Mrs. J., had a drop from 19,000 with 93 per cent polymorphonuclears on the third day of her illness to 8,000 with 86 per cent polymorphonuclears on the fifth day. Two days later the count was 11,000 with 74 per cent polymorphonuclears. She died three days later.

Mrs. T., had a drop in her leucocyte count from 18,000 with 85 per cent polymorphonuclears on the second day of her illness to 8,800 with 90 per cent polymorphonuclears on the fourth day. The count rose to 25,000 with 92 per cent polymorphonuclears two days later and she died the following day.

Mrs. L., had a leucocyte count of 18,000 with 86 per cent polymorphonuclears on the first day after illness. Four days after it had dropped to 5,700 with 89 per cent polymorphonuclears. It rose to 15,900 in two days and then to 25,000 with 92 per cent polymorphonuclears in three days more. She died two days later.

Mrs. F., had a drop from 15,000 with 80 per cent polymorphonuclears on the second day to 7,000 with 79 per cent polymorphonuclears on the fifth day. In four days the count rose to 33,000 with 90 per cent polymorphonuclear leucocytes. About the same time a definite inflammatory mass developed in the pelvis which later suppurated, was drained, and she recovered.

There was a marked drop in hemoglobin values in practically all cases. The average value at the beginning of the infection was 71.5 per cent and there was an average drop of 14.5 per cent during its course to an average low reading being 57 per cent. The beneficial effect of transfusion is shown in Table II.

TABLE II

HEMOGLOBIN DETERMINATION IN TRANSFUSED CASES		
Total number of transfused cases		11
At beginning of infection	71.5%	
Lowest reading	52.5%	
Reading on discharge or death	60.1%	
HEMOGLOBIN DETERMINATION IN NONTRANSFUSED CASES		
Total number of nontransfused cases		14
At beginning of infection	73.25%	
Lowest reading	66.00%	
Reading on discharge or death	66.00%	

Blood Cultures.—Blood cultures were made repeatedly in all cases except one. From seven patients a hemolytic streptococcus was recovered. Six of these seven patients died. The one who recovered gave a single colony on the twenty-sixth day and none thereafter. It is interesting to note the first day postpartum on which the positive blood cultures were obtained, viz.: the second, fourth, eighth, tenth, eleventh, eighteenth, and twenty-sixth (see Table III). The late stages at which the streptococcus was culturable from the blood stream would suggest that the first dissemination of the organisms was by the lymphatics and that from there they reached the blood. This is supported by the findings in the cases which came to autopsy, in all of which there was direct evidence of lymphatic involvement. The occurrence of peritonitis in four, and of pleurisy in one, also is evidence of lymphatic spread. Of the sixteen patients who recovered eight developed an inflammatory exudate in the pelvis and two had symptoms of articular inflammation both of which are usually indicative of a lymphatic spread.

Vaginal Cultures.—In eighteen of the twenty-four patients a hemolytic streptococcus was grown from vaginal smears. In five no smears were

taken and one was negative. The material for culture was taken from just within the vaginal orifice. In one of the earliest cases the cervix was exposed by a speculum and the smear taken from inside the cervical canal. Within an hour she had a chill and the temperature rose to 104° F. although it had been below 102° F. for the previous two days. She ultimately made a good recovery, but thereafter we avoided taking intrauterine or cervical cultures. The number of positive findings proved the method adopted to be adequate for all practical purposes.

When it was realized that we were in the midst of a streptococcal epidemic cultures were taken from within the vaginal orifice of every

TABLE III. CASES WITH STREPTOCOCCUS HEMOLYTICUS IN BLOOD SHOWING DAY POSTPARTUM ON WHICH FIRST POSITIVE CULTURE WAS OBTAINED, THE RESULT AND AUTOPSY FINDINGS*

NAME	FIRST POSITIVE CULTURE	RESULT	AUTOPSY FINDINGS
Mrs. M.	None	Died on 75 day	Multiple abscesses throughout abdomen. Definite evidence of lymphatic spread
Mrs. T.	8 day	Died on 9 day	Diffuse peritonitis Lymphangitic pneumonia
Mrs. N.	None	Died on 5 day	Partial autopsy Diffuse peritonitis
Mrs. J.	10 day	Died on 13 day	Diffuse peritonitis
Mrs. B.	2 day	Died on 3 day	Diffuse peritonitis Lymphatic spread in broad ligaments
Mrs. L.	11 day	Died on 17 day	Diffuse peritonitis
Mrs. C.	None taken	Died on 3 day	No autopsy
Mrs. McG.	18 day	Died on 20 day. Had a pleurisy with streptococci	No autopsy
Mrs. R.	26 day (one single colony)	Discharged on 52 day Had pelvic cellulitis	
Mrs. F.	4 day	Died on 17 day	No autopsy

*Hemolytic streptococcus recovered from peritoneal cavity in all of above autopsied cases.

patient before delivery, immediately after delivery, and on the second, fourth, and seventh days of the puerperium. In no case did we find a hemolytic streptococcus before delivery but from three a hemolytic streptococcus was obtained on the second day of the puerperium. These patients were isolated. Two of them had afebrile puerperium. The culture from one of these was still positive on discharge from the hospital. The third, Mrs. M., after being afebrile for five days had a sudden rise of temperature with a chill, and after a long illness died on the seventy-fifth day. These cases are of interest and importance as showing that the organisms entered into the vagina during or immediately after delivery, that organisms may be present in the vagina and never infect the uterus, and that if the uterus is invaded three days may elapse before symptoms develop. No previous vaginal cultures had been

taken from the two patients who began their infection on the eighth and ninth day postpartum, these cases having occurred before the routine was begun.

Autopsy Findings.—In three of the fatal cases no autopsy examination was permitted; in three the abdomen only was examined; and in three a complete autopsy was made. In all the cases examined peritonitis with free fluid was found. In all there was fibrinous exudate on the intestines. In one there were multiple abscesses in the peritoneal cavity and cellular tissue of the pelvis.

In none was there any evidence of septic thrombophlebitis of the pelvic veins.

In the cases examined fully there was definite evidence of lymphatic spread of the infection in the form of lymphatic vessels chocked with polymorphonuclears and organisms; leucocytic infiltration of blood vessel walls; abscess formation in the uterine wall, in the ovaries, and in the cellular tissue of the pelvis; interstitial lymphatic pneumonia, and pleurisy.

These findings together with certain clinical phenomena already mentioned point to a primary lymphatic rather than a blood borne infection.

TREATMENT

In the treatment of this series of cases of streptococcal puerperal infection three main therapeutic agents were used, viz.: antistreptococcal serum, quinine bi-hydrochloride, and blood transfusion. In most cases a combination of two or of all three was used. Thus five cases, two fatal and three nonfatal, had all three; three, two fatal and one nonfatal, had transfusion and serum; eight, two fatal and six nonfatal, had serum and quinine bi-hydrochloride. (Table IV.)

Antistreptococcal Serum.—This was used in eighteen cases, six of which proved fatal and twelve of which recovered. Five of the fatal cases had a positive blood culture, and eleven of the nonfatal cases a negative culture; the twelfth case showing one colony of streptococci on the plate on one occasion only, late in the disease.

Two types of serum were used, one a polyvalent Lederle serum which was given as a rule in 100 c.c. doses intravenously. The other was a special concentrated serum of Parke Davis and Company, of which 10 c.c. is said to be equal to 100 c.c. of their serum as formerly prepared. This was given as a rule in 10 c.c. doses intravenously. Five patients were given 20 c.c. doses with no untoward result. Other deviations from the general dosage mentioned for both sera will be seen in Table IV. One patient had a 10 c.c. dose of Dochet serum. Three patients showed a marked reaction, two of them during the administration of the Lederle product so that it had to be stopped and one, a late reaction after the concentrated serum. All the others stood it well. The concentrated serum was given to ten patients with three deaths; the ordinary serum to six patients with two deaths. The ordinary and concentrated were both given to one patient who recovered, and the concentrated Dochet serum to one, who recovered.

The first dose of serum was given immediately on the rise of temperature in two cases, on the second day, i.e., within twenty-four hours, in eight cases, and on the

third day in six, on the fourth day in one case, and on the fifth day in one. Ten patients had one dose only, one of these died and nine recovered. Eight patients had two doses, two of these died and six recovered. One fatal case had three doses.

Only two patients had serum as their only treatment. It was given on the second day in each case. Both made rapid recoveries and were discharged, one on the fifteenth day and the other on the seventeenth day postpartum. In two cases transfusion was given along with serum treatment. One patient died and the other recovered.

Antistreptococcal Serum and Quinine Bi-Hydrochloride.—In thirteen cases serum was given in combination with quinine bi-hydrochloride administered intramuscularly in five grain doses. The preparation used was one put up in sterile ampules and it was injected deep into the muscle of the thigh or buttock. This combination of serum and quinine bi-hydrochloride was first brought to our attention by Luker who reported good results which we had confirmed. His routine was the administration of 30 c.c. of antistreptococcal serum on three successive days, and, after that, five grains of quinine bi-hydrochloride in 10 c.c. of sterile distilled water intravenously on the fourth, sixth, and eighth days; 5 grains of quinine bi-hydrochloride in 1 c.c. of water are given intramuscularly on the fifth, seventh, ninth, tenth, eleventh, and twelfth days. By this treatment he has reduced the mortality from 34.2 per cent to 5.6 per cent. Luker believes that the action of quinine bi-hydrochloride in those cases is a general one on the tissue cells.

This precise routine we did not follow. From Table V it will be seen that the quinine was given on the first day of temperature rise in eight cases, on the second day in four, and on the fifth day in two, and that when repeated it was usually, but not always, on alternate days with the serum. Of the thirteen patients treated in this way four died and nine recovered. Late transfusions were given in two of the fatal, and in three of the nonfatal cases. In two patients abscesses at the site of quinine bi-hydrochloride injection developed and from the pus a hemolytic streptococcus was recovered in each case. We have had a similar occurrence in two other cases treated elsewhere.

Blood Transfusion.—In this series of cases blood transfusion was given to eleven patients (Table VI). The direct method was used in four, and the citrate method in seven. The reason why the citrate method was used in the majority of cases was that the transfusion had to be done in the septic wards and it was thought that the donor would be exposed to a definite risk if the direct method were employed. In considering blood transfusion in puerperal septicemia two different aspects of the procedure have to be kept in mind, first, blood transfusions early in the disease as a possible means of increasing the patient's resistance to the invading organisms and their toxins, and secondly, as a supportive measure in long drawn out cases. At the beginning of the epidemic we were relying on the serum and quinine bi-hydrochloride treatment as already outlined because we had had as good results with it as with any other method of treatment in the past, but some of our patients had early transfusions. Five patients were transfused within the first four days of their illness, one on the first day, one on the second and sixth days, one on the second day, one on the third, fifth, and seventh days, and one on the fourth and ninth days. Of these five patients the first two mentioned died and the three others recovered. The two who died had positive blood cultures; the three who recovered had negative blood cultures. One of those who died had a direct, and one, a citrate transfusion. It is interesting to note that in all three who recovered there was a definitely localized pelvic inflammation in the latter part of the disease. Whether this localization can be attributed to the transfusion or indicates a limitation of the infection from the start it is impossible to say.

TABLE IV. TREATMENT

NAME	BLOOD CULTURE	TRANSFUSION		SERUM		QUININE	REMARKS	RESULT
		DAY OF DISEASE AND AMOUNT	METHOD	DAY OF DISEASE AND AMOUNT	SERUM TYPE OF	DAY OF DISEASE AND AMOUNT		
Mrs. B.	Positive	1st—600 c.c.	Direct				Normal delivery	Died on 3rd day
Mrs. J.	Positive	2nd—600 c.c. 6th—500 c.c.	Citrate	3rd—150 c.c.	Lederle		Cesarean section	Died on 13th day
Mrs. McG.	Positive			2nd— 20 c.c. 4th— 20 c.c.	P. D. conc.	1st—5 gr.	Normal delivery	Died on 20th day
Mrs. L.	Positive	12th—250 c.c.	Citrate	5th— 90 c.c. 9th—175 c.c. 14th—210 c.c.	Lederle	2nd—5 gr. 3rd—5 gr. 11th—5 gr. 12th—5 gr.	Normal delivery	Died on 17th day
Mrs. M.	Negative	8th—450 c.c. 24th—500 c.c. 55th—500 c.c.	Citrate	1st— 20 c.c. 4th— 20 c.c.	P. D. conc.	1st—5 gr. 2nd—5 gr.	Peritoneal abscess	Died on 75th day
Mrs. T.	Positive			3rd— 20 c.c. 4th— 20 c.c.	P. D. conc.	1st—5 gr. 2nd—5 gr. 4th—5 gr.		Died on 9th day
Mrs. F.	Positive	10th—500 c.c.	Direct	8th— 20 c.c. 10th— 10 c.c.			Acute mania	Died on 17th day
Mrs. C.	Not taken						Clinical diagnosis of pneumonia following Cesarean section	Died on 3rd day
Mrs. N.	Positive						Cesarean section markedly distended	Died on 5th day
Mrs. F.	Negative	2nd—600 c.c. 6th—500 c.c.	Direct	3rd—100 c.c.	Lederle		Pelvic abscess	Discharged 40th day
Mrs. B.	Negative	3rd—500 c.c. 5th—600 c.c. 7th—500 c.c. 29th—500 c.c. 31st—500 c.c.	Direct				Pelvic cellulitis	Discharged 56th day

TABLE IV—CONT'D

NAME	BLOOD CULTURE	TRANSFUSION		SERUM		QUININE	REMARKS	RESULT
		DAY OF DISEASE AND AMOUNT	METHOD	DAY OF DISEASE AND AMOUNT	TYPE OF SERUM	DAY OF DISEASE AND AMOUNT		
Mrs. R.	One colony on one occasion	4th—500 c.c. 9th—500 c.c. 14th—150 c.c. 24th—300 c.c.	Citrate	2nd— 10 c.c.	Lederle	1st—5 gr. 3rd—5 gr.	Marked reaction after 10 c.c. given	Discharged 51st day
Mrs. C.	Negative	5th—150 c.c. 10th—450 c.c. 17th—500 c.c.	Citrate	1st— 10 c.c. 5th— 10 c.c.	P. D. conc.	5th—5 gr.	Pelvic abscess marked late serum reaction	Discharged 57th day
Mrs. S.	Negative	14th—500 c.c.	Citrate	2nd— 20 c.c. 4th— 10 c.c.	P. D. conc. Dochet	1st—5 gr. 3rd—5 gr.	Cesarean section	Discharged 24th day
Mrs. P.	Negative	29th—100 c.c.	Citrate			2nd—5 gr. 3rd—5 gr. 5th—5 gr.	Trouble with donor	Discharged 51st day
Mrs. E.	Negative			9th— 20 c.c. 11th— 10 c.c.	P. D. conc.	5th—5 gr. 8th—5 gr. 10th—5 gr.	Streptococcal abscess at site of quinine injection	Discharged 26th day
Mrs. W.	Negative			2nd—100 c.c. 5th— 10 c.c.	Lederle P. D. conc.	1st—5 gr. 2nd—5 gr. 4th—5 gr.		Discharged 18th day
Mrs. D.	Negative			2nd— 40 c.c. 4th— 10 c.c.	Lederle	1st—5 gr.	Marked reaction after 40 c.c. serum given	Discharged 13th day
Mrs. L.	Negative			3rd— 10 c.c.	P. D. conc.	1st—5 gr.		Discharged 22nd day
Mrs. S.	Negative			2nd— 10 c.c.	P. D. conc.	2nd—5 gr.		Discharged 16th day
Mrs. F.	Negative			2nd— 10 c.c.	P. D. conc.	2nd—5 gr. 4th—5 gr. 5th—5 gr.	Had diabetes	Discharged 23rd day
Mrs. C.	Negative			2nd— 20 c.c.	P. D. conc.			Discharged 15th day
Mrs. B.	Negative			2nd— 10 c.c.	P. D. conc.			Discharged 17th day
Mrs. S.	Negative						Only medicine was "cholera mixture"	Discharged 20th day

TABLE V. CASES TREATED WITH QUININE AND ANTISTREPTOCOCCAL SERUM

NAME	QUININE DAY ON WHICH GIVEN	SERUM DAY OF DISEASE	OTHER TREATMENT	RESULT
Mrs. McG.	1	2, 4		Death 20th day postpartum
Mrs. L.	2, 3, 11, 12	5, 9, 14	Transfusion on 12th day	Death 17th day postpartum
Mrs. M.	1, 2	1, 4	Transfusions 8th, 24th, and 55th days	Death 77th day postpartum
Mrs. T.	1, 2, 4	3, 4		Death 9th day postpartum
Mrs. R.	1, 3	2	Transfusions 4th, 9th, 14th, 24th	Discharged on 51st day postpartum
Mrs. C.	5	1, 5	Transfused 5th, 10th, and 17th	Discharged on 57th day postpartum
Mrs. S.	1, 3	2, 4	Transfused 14th day	Discharged on 24th day postpartum
Mrs. E.	5, 8, 10	9, 11		Discharged on 26th day postpartum
Mrs. W.	1, 2, 4	2, 5		Discharged on 18th day postpartum
Mrs. D.	1	2		Discharged on 13th day postpartum
Mrs. L.	1	4		Discharged on 22nd day postpartum
Mrs. S.	2	3		Discharged on 16th day postpartum
Mrs. F.	2, 4, 5	2		Discharged on 23rd day postpartum

Transfusion treatment was begun in six cases after the fourth day of the illness and was repeated in two, who had been transfused earlier. Of these six patients three died and three recovered. We were influenced to a certain extent in our choice of transfusion by the fall of hemoglobin early or late in the disease. In Table II it will be noted that in the cases transfused there had been an average drop of 19 per cent in the hemoglobin before transfusion and an average recovery of 6.6 per cent after it. In the cases which were not transfused the average drop in hemoglobin was only 7.25 per cent but there was no rise during the patients' stay in the hospital.

Summary of Treatment.—The results of the three methods of treatment are summarized in Table VII. From this it would appear that the best results had been obtained by serum and quinine bi-hydrochloride, the next best by no treatment at all, and the worst by transfusion. These figures are of course fallacious. Our first treatment in the majority of cases was serum and quinine bi-hydrochloride. A considerable number of patients showed immediate improvement and no other treatment was given. Had our initial treatment been transfusion no doubt equally good results would have been got and the recoveries ascribed to serum and quinine bi-hydrochloride would have gone to the credit of transfusion. Which bears out what has been so often said before, that it is impossible to assess accurately the value of any one method of therapeusis in puerperal sepsis, because a considerable number of patients recover without any treatment and a certain number will die in spite of whatever treatment is used. In this connection a little interlude in the somber story already told may be introduced. One of the attending surgeons refused to believe that one of his private patients, Mrs. S., had the disease in spite of a high temperature with chills and leucocytosis. She had marked abdominal distention with diarrhea and the only treatment she had was

TABLE VI. CASES TREATED BY TRANSFUSION

NAME	DAY OF FEVER ON WHICH DONE AND AMOUNT OF BLOOD GIVEN	METHOD	OTHER TREATMENT	REMARKS	RESULT
Mrs. B.	1st—600 c.c.	Direct		Streptococci in blood	Died on 3rd day postpartum
Mrs. J.	2nd—600 c.c. 6th—500 c.c.	Citrate	Serum	Streptococci in blood	Died on 13th day postpartum
Mrs. M.	8th—450 c.c. 24th—500 c.c. 55th—500 c.c.	Citrate	Serum and quinine	Blood sterile	Died on 75th day postpartum
Mrs. L.	12th—250 c.c.	Citrate	Serum and quinine	Streptococci in blood	Died on 17th day postpartum
Mrs. F.	10th—500 c.c.	Direct	Serum	Streptococci in blood	Died on 17th day postpartum
Mrs. F.	2nd—500 c.c.	Direct	Serum	Blood sterile	Recovery Discharged on 40th day postpartum
Mrs. B.	3rd—500 c.c. 5th—600 c.c. 7th—500 c.c. 29th—500 c.c. 31st—500 c.c.	Direct		Blood sterile Before the second transfusion 300 c.c. of blood was withdrawn	Recovery Discharged on 56th day postpartum
Mrs. R.	4th—500 c.c. 9th—550 c.c. 14th—150 c.c. 24th—500 c.c.	Citrate	Serum and quinine	Blood sterile	Recovery Discharged on 51st day postpartum
Mrs. C.	5th—150 c.c. 10th—450 c.c. 17th—500 c.c.	Citrate	Serum and quinine	Blood sterile In first transfusion hematoma formed round the vein	Recovery Discharged on 57th day postpartum
Mrs. S.	14th—500 c.c.	Citrate	Serum and quinine	Blood sterile Blood sterile	Recovery Discharged 24th day postpartum Recovery
Mrs. P.	29th—100 c.c.	Citrate		Trouble with donor	Discharged on 51st day postpartum

TABLE VII. ANALYSIS OF RESULTS OF TREATMENT

	NUMBER	RECOVERED	DIED	MORTALITY PER CENT
Early Transfusion	4	2	2	50
Early Transfusion + Serum + Quinine	1	1	0	0
Late Transfusion	2	1	1	50
Serum + Quinine	8	6	2	25
Serum + Quinine + Late Transfusion	4	2	2	50
No Transfusion or Serum or Quinine	5	3	2	40
Total	24	15	9	37.5

something known as "sun cholera mixture." She made a rapid and complete recovery. The recovery of the diabetic patient is also noteworthy.

The startling thing in this series of cases is that every patient with a positive blood culture died with one exception, Mrs. R., from whom one colony was ob-

tained on one occasion late in her disease and who ultimately recovered. This high mortality is exceptional as we have all seen cases with positive blood culture recover. The rather late appearance of the positive blood culture in most of the cases and the postmortem evidence of a lymphatic spread may indicate that these patients were saturated with toxins long before blood infection occurred and that the latter was really a terminal phenomenon.

And so from this series of cases it is impossible to dogmatize about treatment, but we can give our impressions and outline a possible method of procedure in dealing with cases of fever in the puerperium. Our impression is that in a hemolytic streptococcal infection blood transfusion done early and repeated on alternate days is as good a form of treatment as any available. It counteracts the fall in hemoglobin and, apparently, in many instances acts as a nonspecific agent in increasing the resistance of the tissue cells to the infection. But many cases of puerperal sepsis occur in domestic practice where early transfusion may not be possible, and there are many cases of fever in the puerperium which subside rapidly, for which no cause is ever found, and in which immediate transfusion would certainly be out of place. For these reasons the following outline scheme of treatment is given, the details to be varied according to circumstances. On the first rise of temperature give five grains of quinine bi-hydrochloride intramuscularly. In many cases the temperature will be found to be normal or nearly normal next day, in which case no further treatment may be required. If temperature and pulse are still high after twelve or twenty-four hours, serum may be given intravenously, the dose being the equivalent of 100 c.c. This may be repeated in twelve hours. Meantime, provision for transfusion should be made. If there is a marked drop in hemoglobin, transfusion is more strongly indicated and should be done on alternate days, no more serum being given but the quinine bi-hydrochloride continued. If the patient shows definite improvement after serum and quinine bi-hydrochloride alone and there is no marked fall in hemoglobin, transfusion may not be required at all. If the case is a long drown out one, transfusion in the later stages materially helps convalescence.

In our present state of knowledge we have no specific treatment for streptococcal puerperal infection. All three therapeutic measures discussed are nonspecific agents which in some cases seem to have a definite action in increasing the patients' resistance but in a certain number they either do not do this or the virulence of the invading organism is such that all the resistance called forth is unavailing.

SUMMARY AND CONCLUSIONS

1. During the period January 16, to February 14, 1927, twenty-four patients, out of a total of one hundred and sixty-three delivered, developed streptococcal infection and eight of them died. One other died later. One baby died of erysipelas. One nurse got a severe streptococcal infection of the arm and recovered. One nurse developed a primary streptococcal peritonitis and recovered after laparotomy.

2. Cases continued to occur after treatment of the operating and delivery rooms with chloride of lime; after a change was made to a delivery room which had never been used before; and they only ceased when admissions to the hospital were stopped.

3. A complete bacteriologic investigation of the hospital failed to demonstrate hemolytic streptococci in the air, on the floors or walls, in the operating rooms, in dressings, supplies, or water.

4. The only place where streptococci were found, other than in the infected patients, was in the nose and throat of certain doctors, nurses, and members of the domestic staff.

5. The exclusion of these carriers from direct contact with patients failed to arrest the epidemic. This may have been because fresh carriers were always being discovered.

6. Masking of the nose and mouth of all in attendance on patients before, during, and after labor failed to arrest the epidemic.

7. Notwithstanding the above, the fact that streptococci were demonstrated in no situation other than the nose and throat of attendants makes it important to exclude streptococcal carriers from maternity hospitals and to insist on complete masking by all in attendance on parturient or puerperal women.

8. The data available are not sufficient to determine whether one or more of these carriers brought the infection in, in the first instance, or whether they picked up the organism from the infected cases. The latter is possibly true in some cases.

9. The occurrence of a primary peritonitis in a nurse shows that there may be points of entry for the hemolytic streptococcus other than the vagina and puerperal uterus, but the finding of the organism in the vagina of nearly all infected patients shows that this was the common portal.

10. The particular streptococcus in this series of infections was a very virulent one.

11. Every patient but one with a positive blood culture died.

12. The late appearance of streptococci in the blood of most of the cases and the postmortem findings point to a lymphatic dissemination.

49 East Fifty-Third Street.

(*For discussion, see page* 286.)

EPIDEMIOLOGIC AND BACTERIOLOGIC INVESTIGATION OF THE SLOANE HOSPITAL EPIDEMIC OF HEMOLYTIC STREPTOCOCCUS PUERPERAL FEVER IN 1927

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IN THESE days of aseptic precautions, a large epidemic of puerperal fever is an unusual event. Sporadic cases and small groups of cases occur from time to time in every obstetric hospital but there are probably very few living today who have been through an experience such as Dr. Watson has described. And yet, there is not one who cannot imagine himself in that situation and has not speculated what he would do to check such an epidemic if it were to occur in his own hospital. For if it occurred in one well-organized and well-run hospital, it is likely to occur in any hospital under the same or similar circumstances.

Let it be stated at the outset, however disappointing that information may be, that our study of the situation has not given us the knowledge necessary to prevent epidemics of puerperal fever, but we believe that we have derived some facts which give us a better understanding of the nature of such epidemics, which will permit us to minimize the risk of a recurrence and which would enable us to check another such epidemic in an earlier stage than this one was checked. The purpose of this report is to pass on our results for what they are worth and to add them to the literature so that they may be available to others who may be interested. We shall frankly confess our mistakes and our shortcomings and these were many. We fell far short of learning all there was to learn, particularly in the early stages of the epidemic, the steps of which we can only surmise from the facts obtained later.

A review of the literature from the classic essay of Oliver Wendell Holmes[1] and circumstantial evidence of etiology by Semmelweis[2] give the impression that in their time it was acknowledged by unprejudiced observers that the doctors and midwives were the chief agents in spreading the disease, but some years later after the application of aseptic principles, it was supposed that they were thereby absolved from further responsibility in the matter. The more recent literature is filled with studies of sporadic cases in given clinics over varying periods of time. There are very few reports of real epidemics and in these there is a paucity of information about the preepidemic or early epidemic stages.[3] An epidemic is always several days or several weeks old be-

fore it can be called an epidemic. It is only the constant repetition of similar cases that makes one aware of its presence.

Dr. Watson has described the repetition of events which led him and his staff to realize that an epidemic of a very virulent nature was in full swing. He called for help from a number of sources. When these had responded and held council with his staff, the situation was studied in detail. It should be pointed out that no one in the group had ever faced a similar situation before. A number of surveys were made of the physical plant and the methods used in caring for the patients from the time they entered until they were discharged. As a result of the survey these facts were evident:

1. *The technic of admitting and delivering patients had not been radically changed.*—Five or six patients were admitted daily, given a preliminary vaginal examination, and if not in labor sent to the wards. Before delivery they were prepared by shaving with a razor and washing with soap and water and alcohol. During the first stage of labor vaginal examinations were avoided if possible. For vaginal examinations rubber gloves were used by the examiners but no masks were worn. During the second stage of labor the external parts were again washed with soap and water and painted with 3½ per cent iodine. A sterile towel was placed over the delivery table beneath the buttocks and sterile sheets over the thighs and abdomen. The vagina and anterior part of the anus were exposed. The doctors and nurses wore gowns, gloves, caps, and masks which covered the mouth but not the nose. After delivery the vagina was covered with a sterile pad held by safety pins to a circular binder. If a perineal tear had occurred, sterile pads were placed beneath the buttocks and not over the vulva. On return to the wards these sterile pads were changed every four hours or oftener if they became soiled. The nurses caring for the postpartum cases were not masked.

2. *The comings and goings of staff members, nurses in training, and visitors had not been materially altered.*—Aside from the attending and house staff, from 14 to 26 nurses came each month from seven other hospitals for three months of training. Visitors consisting of husbands and mothers were admitted three times a week to the wards and more often to the semiprivate and private rooms.

3. *The preparation and distribution of sterile and clean operating room and laundry supplies had not been modified.*—Gloves, towels, vulva pads, sponges, and compresses were prepared in two different autoclaves, under the direction of an experienced nurse. Sterilization was controlled by pressure gauges and thermometer recorders. Solutions were sterilized in a general autoclave. Sterile water was prepared in several different water sterilizers. Sheets and clean towels were delivered daily from the laundry. Soiled linen from cases on individual precautions was sterilized by soaking in lysol and then boiling.

4. *The serving of food and the care of trays had not been altered.*—Food was brought up to the ward pantries from the kitchen in large containers, distributed to the individual trays and kept warm in steam wagons in transit to the wards. Trays and dishes from patients on "individual precautions" were sterilized after use. Bed pans were all sterilized after use in steam bed pan sterilizers. After use by patients "on individual precautions," bed pans were soaked in 5 per cent lysol until used again.

5. *The delivery rooms were distributed as follows:*—(a) One was on the ground floor with windows opening on a delivery and automobile parking court. This had several rows of benches for students' clinics separated from the main part

of the room by a railing. (b) Another was on the third floor with windows opening on an ell of the same court, somewhat more protected. These two rooms were ventilated by a current of air driven up from the cellar by a fan and opening near the floor. These ventilators were not protected by filters. (c) The gynecologic operating room where the cesarean sections were performed was on the seventh floor with windows opening above a court.

6. *A scrutiny of the individual cases as they appeared brought out some interesting facts from an epidemiologic viewpoint.*—The fatal and seriously ill cases apparently had only one thing in common, namely childbirth with its inevitable vaginal exposure to trauma and contamination. Some were primipara, others were multipara. Some had normal positions and others abnormal ones. Most had intact membranes on admission, a few had ruptured membranes. Some had spontaneous labor, others required the use of instruments, and still others had cesarean section performed. They were delivered in three different operating rooms and there was no single member of the staff present at all deliveries. The postpartum course was strikingly similar in all of the cases. After delivery the course was normal for the first two or three days and then suddenly the presence of an infection was announced by a rise to 104° or 105° F. Thereafter in most cases the patient's course was stormy. The first fatal case died forty-eight hours after the temperature rise with what appeared to be fulminating pneumonia. No cultures were taken and no autopsy was performed. The second fatal case died suddenly with peritoneal symptoms four days after the temperature had risen. In this instance no cultures were taken before death, but at the autopsy a peritonitis was found and smears showed gram-positive cocci and gram-negative bacilli. The cocci could not be recovered from the contaminated culture. The third fatal case had definite peritonitis and cultures were obtained at autopsy. These were at first reported to contain a pneumococcus but further examination revealed the organism to be hemolytic streptococcus. In all subsequent cases the organism was frankly recognized as a hemolytic streptococcus, and when the staff and advisors met to consider the situation, it was recognized by all that they were dealing with an epidemic of puerperal fever caused by the hemolytic streptococcus.

This led to a consideration of the following questions:

A. *Where did the organism come from?* Was it brought in by the patients, by staff members, by visitors, in the food or in the dust from the street?

B. *Where is the organism now?* Is it in the sick patients only? Is it being carried by well patients? Is it being carried by one or more ill or one or more well staff members? Is it in the delivery rooms, operating rooms, the wards, in the "sterile" solutions and supplies, or in the laundry?

C. *When did the organism get into the patients?* Did it enter before admission; at the first vaginal examination; during the first, second, or third stages of labor; after the delivery of the placenta; or when the patients were in the wards after delivery?

D. *How did the organism get into the patients?* By the vagina, on the hands of the examiners, on the instruments or solutions used in shaving, on the hands of the operators, from towels, pads on the operat-

ing table beneath the patients, from anal discharges? Or did it enter through the nose or mouth?

E. *What is the nature of the organism?* Is it a single strain or does each case represent a different strain? Has it a special affinity for the vagina and uterus? Will it grow elsewhere? Is it multiplying in the hospital?

It was obvious at once that to attempt to answer all of these questions would require a considerable amount of work in bacteriology. This the laboratory of the hospital, already taxed to capacity with routine duties, was unable to do. At the earnest solicitation of Dr. Watson and at the direction of Dean Darrach and Dr. Whipple, Professor of Surgery, the bacteriologic section of the Surgical Research Laboratories was given over to this work because one of us had recently made a successful study of a small epidemic of hemolytic streptococcus wound infections following operation in the surgical service of the Presbyterian Hospital.[5] Our own problems were temporarily suspended because of the urgency of the situation, but some days passed before the work could be organized and the necessary technical help procured. The first bacteriologic survey of the hospital was begun just eighteen days after the delivery of the first sick patient of the series. These facts are mentioned not as an excuse for our failure to find out more than we did about this epidemic but to stress the need, as we shall do later, for a running organization immediately available for the study of such cases as they arise, if a satisfactory study is to be made and results of paramount importance are to be obtained.

THE SCOPE OF THE PROBLEM

A. We attacked the problem by attempting to answer the questions enumerated above. The first question, "*Where did the organism come from?*" could not, of course, be answered definitely because of the progress which the epidemic had already made, but some light might be thrown upon it by a general consideration of the biologic relationships of this bacterium. The hemolytic streptococcus is a very extensively distributed organism. It is always active and particularly conspicuous as a cause of disease in the late winter and early spring months in temperate climates and all through an "open" winter with changeable temperature as the winter of 1927 was. The organisms occur not only in the nose and throats of persons suffering from colds and sore throats, but in the nasopharynx of normal persons who may come in contact with them. Certain people carry them for months in the crypts of tonsils.[4] Others pick them up and carry them for a few days or a few weeks only. Hemolytic streptococci multiply readily in the human nose and throat and persons who are carrying them in these places are constantly discharging them when coughing or sneezing and even during speaking and breathing. It has been demonstrated that during an operation, a wound may be contaminated by, and an infection result from, an organism discharged upon the sterile field from the unmasked nose of one of the operating staff.[5] When streptococci are growing in the nose or throat, many are swallowed and while most of these are killed in the stomach, a few may be carried through the intestines and be discharged in the feces.[6] From the nose and mouth, streptococci

are transferred to handkerchiefs and hands and by the hands to other objects. A "sterile" field may be contaminated if masks are not worn by the attendants, and the organism may be transferred from one object to another. When outside the body, hemolytic streptococci die off rapidly, particularly if exposed to sunlight but they may live in the cold under artificial conditions, when completely dried, for a number of years. The transfer from person to person may be directly from mouth to mouth or by contact of hands or objects touched by the hands.

Streptococci occur normally in the vagina but the hemolytic varieties are relatively rare even in pregnant women. Of course, streptococci in the nose or throat or vagina are on the physiologic exterior of the body. They do not cause disease unless they penetrate into the interior. There must be a combination of factors operating to bring this about. Certain of these factors are well recognized while others are little understood. Human beings vary considerably in their susceptibility to invasion. Among the variable factors in the host are: the presence or absence of an actual break in or an injury to the surface cells; an altered physiologic state such as the congestion or the excessive exudation of surface secretions; local tissue immunity or hypersusceptibility; general cellular or humoral immunity or hypersusceptibility; variations in general resistance accompanying chilling, starvation or wasting diseases. Likewise different strains of hemolytic streptococci vary and the same strain at different times varies considerably in its invasive properties. Aside from the factors of the number of organisms inoculated and the site of inoculation, there are the factors of diffusible toxins, digestive ferments, capsule formation, and the nature of and the immediacy of transfer from the immediately preceding environment of the bacteria. Experimentally we can increase the invasive properties of certain strains of hemolytic streptococci by injecting lethal doses from one to another of a given species of animals. Often as the virulence increases for one species it decreases for another. There is, therefore, no correlation possible between man and animals by which the virulence of a given organism may be tested at any given time. In some instances the virulence may be enhanced rapidly by a few animal passages, in others it requires many passages and in others the virulence cannot be enhanced at all.

To account for sporadic cases of puerperal sepsis, the factors operating in the host are probably just as important as the factors inherent in the organism. To account for an epidemic of such proportions as this one, it is more logical to look for the chief factors in the invading organism. Here we were probably dealing with an average group of women, varying from each other in susceptibility but as a group not unusually susceptible. There was probably introduced among them an organism of great invasive properties for human beings. The supposition is that it had increased its virulence by frequent passages through human beings. This may have occurred by passing the organism from mouth to mouth until its progeny in succeeding generations found it easy to grow in the environment of human tissues even when introduced in relatively small numbers. It is not likely that this could have been accomplished by passing through a series of normal throats without invading the tissues but it is quite likely that this could have been accomplished by passing through a series of throats if in some of them it had actually invaded the tissues and had overcome to some degree the local resistance of those tissues. There is always the possibility that some unknown factor, a symbiotic organism for instance, entered the situation and increased the virulence of the streptococcus to an unusual degree in a very short time. It may have come fairly directly from any fatal human infection, even from a case of puerperal sepsis. It is not necessary to assume

any specific affinity of this organism for uterine tissue. In parturient women, the large denuded and ragged inner surface of the uterus is, for a few days at least, a fruitful field for the growth of any virulent organisms which may be planted there. It would seem to be a better field than the perineal tissues of a gynecologic operation or the relatively normal peritoneum exposed during a laparotomy. It simulates more closely the ragged lacerated tissues of a gunshot wound of soft parts.

In the days of Holmes and of Semmelweis, epidemics of puerperal fever were common events. There seems to be no room for doubt that there was direct transfer by the hands in some of these cases but where intervals occurred between cases, as in the experience of certain country practicing obstetricians, the supposition is that they carried the organisms in a place where they could grow, such as the nose and throat, and that the contamination of the hands immediately preceded the introduction of the organisms into the vagina of the patients. When hands were carefully washed epidemics dimished. Later when gloves were worn and sterile instruments and supplies were used the epidemics were still further reduced in number. In the present situation, we had to assume that the epidemic was caused by the coincidence of a number of factors. In order to attack it, the obvious course was to attempt to prevent the operation of any of the factors which we might find to be at work.

With these ideas in mind, as a basis for immediate action, the theory was tentatively held that the organism was being introduced into the vagina of the patients by members of the hospital staff either just before, during, or just after delivery, and that it was being carried by one or more members of the staff in the nose and throat. Inasmuch as masks were not worn at all by the doctors during the preliminary examinations, and because of the fact that during the delivery process the mouths of the attendants were masked but not the noses, and in the wards after delivery the nurses were not masked, it was suggested that rigidly complete masking be practiced, that antepartum examinations be dispensed with, that more extensive preparation of the operative field be carried out and that an attempt be made to find out what members of the staff were carrying the hemolytic streptococcus.

B. In an attempt to answer the question *"Where is the organism now?"* cultures were made extensively throughout the hospital. This bacteriologic survey was not accomplished all at once. Cultures were taken in the order of their apparent importance at the time. First vaginal cultures of patients with fever, then nose and throat cultures of the staff, then the air and objects in the operating rooms and wards, then the supplies and solutions, then the nose and throat cultures of the sick patients and lastly vaginal as well as nose and throat cultures of all of the patients. As stated above, the first extensive bacteriologic survey was begun just eighteen days after the delivery of the first case in this series. In the meanwhile a large group of nurses and one of the doctors had left the hospital.

The cultures were made directly on 5 per cent sheep's blood agar plates. Vaginal cultures from the patients revealed hemolytic streptococci greatly predominating and sometimes in pure culture in all but one of the patients showing the typical symptoms of puerperal fever. The explanation of the failure to find it in this case is not apparent. Three other patients also yielded hemolytic streptococci from the vagina and one of these, three days later, entered into the typical symptoms of the malady, while the other two remained well. Inasmuch as, at first, vaginal cultures were only taken on patients with a fever, all of which were postpartum, it came about that in no case of puerperal fever was an antepartum vaginal culture taken, so that we could not tell from the cultures alone

whether or not these patients were bringing the organism into the hospital. It so happened that when routine antepartum cultures were taken not one was found to yield a hemolytic streptococcus in about 170 examinations.

Cultures from the nose and throat of ten of the ill patients yielded no hemolytic streptococcus. The others were not examined. Of 31 patients without puerperal fever, one carried hemolytic streptococcus in the throat.

In order to have some idea of the distribution of the organism by the sick patients, cultures were made from the bed sheets and thighs of four of the patients with positive vaginal cultures, two of them with and two of them without symptoms of puerperal fever. Curiously enough the two who were ill yielded no organisms either on their thighs or beds. This may have been due to their more careful isolation. Of the other two, hemolytic streptococci were found on the bed and on the thighs of one but only on the bed of the other. The stools of three of the patients were examined but yielded no hemolytic streptococci.

Cultures from the nose and throat of the professional staff revealed many carriers of hemolytic streptococci. The figures are shown in Table I. The difference between the nursing staff and students as compared with the other persons including the doctors, the administrative staff, and the patients, is very striking. Subsequent cultures on the positive cases showed that some of these were transient and some were chronic carriers. Treatment with antiseptic sprays and washes was carried out vigorously to minimize, if possible, the number of bacteria discharged by the carriers. This was probably responsible for a certain number of negative cultures, but whether it markedly affected the carrying state of the chronic carriers is questionable. All incoming nurses were cultured upon their arrival. The respective hospitals from which they came were later directed to culture them before departure and send no carriers of hemolytic streptococci.

TABLE I. HOSPITAL PERSONNEL AND PATIENTS YIELDING HEMOLYTIC STREPTOCOCCI FROM NOSE AND THROAT CULTURES IN THE MONTH OF FEBRUARY, 1927

	NURSES	DOCTORS	STUDENTS	NONPROFESSIONAL STAFF	PATIENTS
Total number examined	100	26	12	60	41‡
Number positive throat cultures	18	2	2	2	1§
Number positive nose cultures	6	1	1	1	1
Number of positive carriers	20*	2†	3	3	2
Percentage of carriers	20	8	25	5	4

*Four of these yielded organisms from both the nose and the throat.
†One of these yielded organisms from both the nose and the throat.
‡Ten of these were puerperal fever cases.
§This patient was not one of the puerperal fever cases.

Cultures from the sterile supplies in every instance yielded no growth of any kind; towels, gloves, compresses, sponges, and vulva pads in unopened bags were sterile. After the vulva bags had been opened organisms were found in the pads but these were *not* hemolytic streptococci. Towels, sheets, and blankets stored in the linen closets as well as those in the baskets from the laundry showed many organisms but in no instance any hemolytic streptococci.

Cultures from the water sterilizers yielded no growth in six examinations from the hot tanks; but in three of twelve examinations from the cold water tanks the culture yielded gram-positive and gram-negative bacilli but no streptococci.

Plates were exposed for periods of one-half hour to a day in the operating rooms and wards. The air coming from the ventilators and through the windows of the

operating rooms from the street was cultured also. In no instance was a hemolytic streptococcus found. Cultures from operating tables also yielded nothing.

The results of this survey and later cultures seemed to indicate that the only places where the hemolytic streptococci were present in sufficient quantities to be readily cultivable were the vaginas of the patients and the noses and throats of the attending staff. Inasmuch as it was not possible to determine by any rapid method, as will be pointed out later, whether the strains recovered from the staff were identical with or similar to the cultures from the patients, it was deemed wise to relieve the carriers from duty until their throat and nose cultures should be negative on two successive examinations on alternate days. The ill patients were isolated and put on strict individual precautions and nurses with positive throat cultures were placed in their charge. Suspicious cases including the two patients with positive vaginal cultures without symptoms were put in separate isolated wards under close observation.

C. In an attempt to answer the third question, *"When did the organism get into the patients?"* a careful analysis was made of each case. It was noted that in most of the cases the first peak of fever came on the third, fourth or fifth day after delivery. In Holmes' classic essay he states that in most of the cases of puerperal fever observed by or reported to him, the symptoms began in twenty-four to seventy-two hours. This would suggest that in our series there was either a smaller inoculum, or the organisms were introduced postpartum, or that in those early cases of Holmes, the introduction took place antepartum and had a period of incubation before the delivery took place. It has been found that it requires three to four days for vaginal organisms to get up into the uterus after delivery.[7] In our routine vaginal cultures the findings of a positive culture on the second day postpartum with the typical symptoms developing on the fifth day shed some light upon this point. It indicated that the organisms had been introduced some time before the second postpartum day and had an incubation period in the vagina and uterus of at least three days. It is of particular interest that three of these cases were delivered by cesarean section. We cannot say whether in these cases the organisms were introduced directly into the peritoneal cavity or into the vagina before or after delivery. During the same period no hemolytic streptococcus infection occurred in gynecologic cases operated on in the same room.

A study of the development of the cases gave no evidence of spread within a ward from patient to patient. The cases appeared here, there, and everywhere. All of the wards and all of the delivery rooms were concerned.

These facts seemed to lend weight to the idea that the patients were themselves bringing the organisms into the hospital. The general prevalence of hemolytic streptococcus infections throughout the city and rumors of similar epidemics in other hospitals made this idea worthy of consideration. On the other hand if such were the case one would have expected a more rapid development of symptoms. Furthermore, the occurrence of cases was far greater than could be accounted for by this source unless the prevalence of positive postpartum cultures were far greater than had ever been previously reported. Here 15 per cent of the admissions were coming down with puerperal fever whereas routine antepartum vaginal cultures reported by other observers had yielded no hemolytic streptococci in some series and the largest number we could find reported in the literature was 10 per cent.[8]

After the period of hospital closing was over and patients began to come in again we took cultures immediately on admission, antepartum and postpartum, and on the second, fourth, and seventh days. This was continued for three months and not once in 170 cases was a hemolytic streptococcus found on admission, and no positive vaginal cultures developed subsequently. The theory of the patients carrying the organism was finally disproved by the results of the biologic study

of the different strains of the organism, as we shall see later, although our findings do not preclude the possibility that the first patient brought the organism into the hospital.

D. The question, "*How did the organism get into the patients?*" is the question of paramount importance from the point of view of epidemiology. In fact it is the essence of the whole matter. We confess frankly that our data fail to answer it and give us very few actual facts to base judgment upon. We must approach this question by a process of exclusion. We believe that the negative cultures from the noses and throats of the sick patients argue against a hematogenous infection with the portal of entry in the nasopharynx. The biologic relationships of the different strains also make this possibility extremely remote. The negative stool cultures, although not numerous, bring evidence against the idea that the intestines were the source of the organisms. The pathologists found evidence in most cases that the uterus was the chief site of infection with an extensive lymphatic spread. The most likely route by which the uterus could be infected is by the vagina. Vaginal examinations and deliveries are not sterile procedures. It is not possible by any method that we know to sterilize the vagina or even the vulva. Organisms may be wiped in from the labia during the examinations or during delivery, or may be carried in on gloves, sponges, forceps or packing, or anything else which may be introduced. In this series of cases it is evident that the infecting organism was one of very high virulence, so that the introduction of a very small number of organisms might easily result in an infection, a number which under ordinary circumstances would be readily taken care of.

E. The question of *the nature of the organisms* has required seven months of intensive bacteriologic and serologic work to answer, but we believe that we have been able to answer certain phases of it with some assurance that we are on solid ground. During the epidemic we were able to collect 54 strains of hemolytic streptococci from the patients and from the noses and throats of the staff. Unfortunately the nose and throat cultures from the doctor who was associated with so many of the early cases were unsatisfactory because they had to be made in fluid medium. No hemolytic streptococci were recovered and further cultures were not possible because he left the city. The chief problem in working with these strains consisted in attempting to prove that any two of them were identical organisms. In our present knowledge of the biology of the hemolytic streptococcus this can be done only by the demonstration that the two strains are antigenically exactly alike, as Krumiede has shown.[9] Only identical organisms are antigenically exactly alike, and they will behave exactly alike under conditions of reciprocal cross absorption of agglutinin. By this is meant that when two identical strains are injected into different animals in the proper way, these animals will produce agglutinating immune sera which will agglutinate both of the strains. Moreover, when a sufficient number of these organisms are placed in contact with the serum for a short time, the organisms clump and fall to the bottom of the tube carrying with them the agglutinin. If the mixture of serum and organisms is centrifuged and the supernatant fluid is examined for agglutinin, it will be found that the agglutinin has been completely absorbed from the serum by the organisms. By reciprocal absorption of agglutinin is meant that either of two identical strains will completely absorb out the agglutinin not only from its own serum but from the serum produced by the other strain. On the other hand, it has been found that any given hemolytic streptococcus when injected into animals will produce an agglutinating antiserum which will agglutinate not only itself (the homologous strain) but many other strains of streptococci (heterologous strains). If, however, these heterologous strains are put in contact with this serum for a time and then the mixture is centrifuged, it is found that the supernatant serum, although

it will no longer agglutinate the heterologous strains used for absorption, will still agglutinate the homologous strain. In other words, heterologous nonidentical strains have not the power to completely absorb the agglutinin for the homologous strain.

In order to try the reciprocal absorption of agglutinin test in this series of strains, 7 of the 54 strains were selected for animal inoculation. Four of these strains were obtained from the blood in fatal cases, two were obtained from the vagina of two other sick patients and one from the throat of one of the doctors who was intimately associated with a number of the cases, and who proved to be a chronic carrier of the hemolytic streptococcus.

The details of this serologic study have been reported elsewhere.[13] Suffice it to say here that good agglutinating serum for 4 of these 7 strains was finally obtained: three were from the patients and one from the doctor. When these sera were tested for agglutination against each of the 54 strains from the epidemic, it was found that with a few exceptions the strains from the patients all fell into one group, but that the strain from the doctor's throat showed no agglutination and that the serum produced by this strain could not agglutinate any of the strains from the patients. Similarly, the majority of the strains carried in the noses and throats of the staff proved to give entirely negative tests. However, 6 of the nurses' strains fell into the same agglutinating group as the great majority of the patients.

When in turn, fresh animals were inoculated with these 6 strains and agglutinating serum obtained for them, it was found that only one of the nurse's strains fulfilled the requirements for reciprocal complete absorption of agglutinin. The strain from this nurse's nose and 5 of the patients' strains were demonstrated by this test to be biologically identical. These tests were repeated again and again and the results were always consistent (see Table II). Although it was not necessary nor warranted to obtain sera for all of the strains in the collection, it was found that ten of the other patients' strains completely absorbed out the agglutinin from the serum produced by the nurse's strain. Thus was demonstrated the probable identity of these 10 others besides the first 6. This included the 2 strains cultured from the vagina of the patients not clinically ill but who were vaginal carriers of the organism. Such a relationship was demonstrated also for the strains recovered from a nurse who during the progress of the epidemic was taken ill with hemolytic streptococcus peritonitis, and for the strain recovered from a nurse who developed an axillary abscess following the prick of the finger with a safety pin.

The strains from 5 of the patients failed to fall into the main biologic group. This may mean that they were casual, sporadic cases occurring coincidental with the epidemic but not a part of it. It is more likely, however, that these strains became changed during their frequent transplantations with respect to their agglutinating characteristics. All workers with agglutination of streptococci have observed these changes. It must be emphasized, therefore, that negative results prove nothing and this applies to the negative results with certain of the strains from noses and throats of the attendants as well as those from several of the patients. When negative results occur, we can only say that we have no evidence of identity or similarity. On the other hand, consistent positive results are always significant. Therefore, if out of all of these strains we had found only three identical, two from the patients and one from the staff, we would have been able to say with some assurance first, that this series of cases constituted a true epidemic and the organism was spread either from a common source to both patients or had passed directly from patient to patient, and second, that it was capable of being carried in the nose and throat of a member of the staff.

TABLE II. A CLASSIFICATION OF THE 54 STRAINS OF HEMOLYTIC STREPTOCOCCI OBTAINED FROM HOSPITAL PERSONNEL AND PATIENTS DURING THE EPIDEMIC OF PUERPERAL FEVER BY RECIPROCAL AGGLUTINATION AND ABSORPTION OF AGGLUTININ TESTS

STRAINS PROVED ANTIGENICALLY IDENTICAL BY RECIPROCAL TESTS				STRAINS PROBABLY IDENTICAL FULLY ABSORBING AGGLUTININ				STRAINS ANTIGENICALLY DISSIMILAR WHEN TEST WAS DONE†			
NAME		DELIVERED		NAME		DELIVERED		NAME		DELIVERED	
Patient	L.+	Jan.	18	Patient	J.+	Jan.	18	Patient	Wh.	Jan.	29
"	E.	"	20	"	P.	"	26	"	Ce.	Feb.	7
"	Mc+	"	31	"	D.	"	27	"	Se.	"	9
"	R.	Feb.	2	"	T.+	"	29	"	Co.	"	10
"	Ma #+	"	7	"	F.	"	30	"	Se.	"	18
Nurse	H.		----	"	Ba.	Feb.	5	And twenty-two other strains from the noses or throats of nurses, doctors, students, nonprofessional staff, and patients.			
				"	O.*	"	6				
				"	Bl.	"	10				
				"	N.*	"	11				
				"	Wo.	"	13				
				Nurse	S.‡		------				
				"	Mo.§		------				
				And nine other strains from patients' metastic foci.							

+Indicates the fatal cases. From several of the early cases no cultures were obtained for this study.

#This case yielded a positive vaginal culture on the second day postpartum but did not give clinical signs of puerperal fever until three days later.

*These cases yielded positive vaginal cultures but never showed any clinical signs of puerperal fever.

†It should be borne in mind that negative results with the reciprocal agglutination and absorption tests do not mean that these strains were not at one time similar to or identical with the other strains but simply that this similarity or identity cannot be demonstrated. Only positive results are significant.

‡This strain was cultured from the peritoneum of the nurse with peritonitis.

§This strain was cultured from the axillary abscess of the nurse who pricked her finger with a pin.

This obvious question arises: Was the nurse, whose nose culture proved to be identical with 5 of the patients, the common source of all of the infections or did she accidentally pick up the organism from the original carrier or from a patient. The evidence seems to be definite that she was not the original carrier, for she did not come to the hospital until after the epidemic had started and her first cultures were negative. The nurse who was taken ill with peritonitis (the organism from which lesion is antigenically similar, if not identical with the 6 identical strains) was in the hospital some time before the epidemic began. Her illness began with swollen glands of the neck but one previous culture yielded no hemolytic streptococci from her nose or throat. Her sickness did not develop until twenty-seven days after the delivery of the first patient in the series. While it is entirely possible that she carried the organism for this length of time in her nose and throat and it was not found, it seems to us to be much more likely that she picked it up during the epidemic and that it invaded her soon afterward. These nurses were, therefore, victims rather than originators of the epidemic. It is not at all unlikely that they were in part responsible for its continuance.

SUMMARY

The facts brought out by this study may be summed up as follows:

1. Between January 18 and February 18, 1927, an epidemic of puerperal fever raged in the Sloane Maternity Hospital with approximately

15 per cent of all parturient patients attacked by the disease and with approximately 33 per cent mortality.

2. In the lochial discharges of all but one of the ill patients from whom vaginal cultures were taken, the hemolytic streptococcus was found.

3. Five of these strains were proved to be antigenically identical by cross agglutination and cross absorption of agglutinin tests.

4. Nineteen other strains were proved to be similar if not identical by the absorption of agglutinin tests.

5. Two vaginal strains from patients not clinically ill are included in the nineteen just mentioned.

6. Twenty out of one hundred nurses were found to be carriers of hemolytic streptococcus either in the nose or in the throat or in both places.

7. Two out of twenty-six doctors were found to be chronic carriers.

8. Three out of sixty members of the nonprofessional employees of the hospital were found to be carriers.

9. Ten of the ill patients and 31 of the other patients were examined for the hemolytic streptococcus in nose and throat. None of the puerperal fever patients yielded positive nose or throat cultures and only two of the well patients.

10. In a serologic study of the strains recovered from the staff one strain from the nose of a nurse was proved by reciprocal cross agglutination and cross absorption of agglutinin tests to be identical with the 5 identical strains from the puerperal fever cases mentioned above. Thus it was demonstrated that the organism could be carried in the nasopharynx without causing serious illness.

11. One strain from the axillary abscess of a nurse whose finger was pricked and one strain from the peritoneum of another nurse taken ill during the epidemic were proved by absorption of agglutinin tests to be similar to, if not identical with, the identical strains from the puerperal fever cases.

12. Twenty-eight cultures of the air in the operating rooms and wards, including the isolation and the septic wards, made by leaving blood agar plates exposed from one-half to twenty-four hours, in no instance yielded hemolytic streptococci.

13. Cultures of linen from the laundry and blankets in the linen closets yielded no hemolytic streptococci.

14. These organisms could not be found in the sterilized supplies and fluids.

15. The peak of fever, indicating the clinical onset of the disease, came on an average of four days postpartum and 72 per cent of the patients had their first peak on the third, fourth, or fifth day postpartum.

16. In one of the cases which later proved to be fatal, hemolytic

streptococci were found in the vagina on the second day postpartum, and the onset of clinical symptoms came three days later.

17. Four of the patients were delivered by cesarean section.

18. In the early stages of the epidemic, antepartum vaginal examinations were made by the staff members with the nose and mouth unmasked. Delivery was carried out with the operating staff with masked mouths but not noses. Nurses caring for the patients after delivery were not masked at all.

19. The infection arose in cases delivered under variable conditions in different delivery rooms and sent to different wards after delivery.

20. The strains from the patients proved to be very virulent for rabbits, small quantities of living culture often killed after months of intravenous inoculation of dead organisms.

CONCLUSIONS

From these facts it would seem logical to conclude that:

1. This series of puerperal fever cases constituted a true local epidemic.

2. The organisms did not enter the patients by the portals of the nose or throat.

3. It was not a hematogenous infection.

4. Each patient did not carry her own strain of hemolytic streptococcus in the vagina on admission to the hospital.

5. The organisms entered the patients either just before, during, or directly after delivery.

6. The portal of entry was the vagina.

7. It is extremely unlikely that these organisms passed directly from patient to patient. In all probability they were conveyed to the patients by one or more carriers.

RECOMMENDATIONS

Although the facts do not permit us to draw more definite conclusions as to the time and manner of introduction of the organisms into the patients, they serve as a logical basis for certain suggestions for procedure until more is known about the preepidemic and early epidemic stages.

Prevention of disease is seldom as spectacular as cure. It only appeals to the most far-sighted mind. Prevention is expensive if carried out to the finest detail, but the ideal should be approached as nearly as possible and funds should not be difficult to obtain for preventive measures when some shocking experience like this is encountered which crystallizes, and thus makes visible its practicality.

It is impossible to prevent the entrance into a maternity hospital of a virulent organism capable of producing an epidemic of this kind, but the chances of its entrance may be reduced to a minimum and it is

possible to discover its presence soon after its arrival. At the same time the chance of its introduction into the vaginas of patients before, during, and after delivery may be minimized. If it has entered, it may be promptly isolated and the epidemic may be stopped. We are hoping that this study will influence the authorities of obstetric hospitals hearing or reading this report, until further facts are established with regard to puerperal fever, to find ways and means to adopt every measure by which these things may be accomplished.

We believe that:

1. There should be a group of workers constantly busy taking weekly nose and throat cultures on staff members. Similar cultures as well as vaginal cultures should also be taken on every patient on admission and in the postpartum course as indicated. The only way that facts can be determined about the preepidemic or early epidemic stages is to have such an organization. The only way we found the solution of the problem of streptococcus wound infection at the Presbyterian Hospital mentioned above, was that the stage was all set for the development of the last case. A group of investigators called in during the middle of an epidemic can do little to stop it and can determine very few facts regarding it. It is very analogous to the difference between a permanent and a voluntary fire department. The former is constantly determining fire menaces and is ready at a moment's notice to put out fires soon after they begin. With the latter there is no fire prevention and when fires occur the individuals have to leave their personal duties, get together, collect some makeshift apparatus, and often reach the fire when it has already spread from cellar to attic.

2. If staff members are found to harbor hemolytic streptococci they should be relieved from duty if possible. In any case they should be kept isolated from the parturient patients just before, during, or just after labor. Active local treatment of the nose and throat should be rigidly followed.

3. All nurses coming for training should have cultures made from nose and throat in their own hospitals and not admitted if these cultures are positive.

4. Patients with positive cultures in nose or throat or vagina should be isolated and local treatment be regularly carried out.

5. Antepartum examinations should be minimized and all examiners and all attendants should mask both nose and mouth during the examination.

6. During labor the attendants should rigidly mask both nose and mouth.

7. After delivery the attendants should adequately mask both nose and mouth whenever vaginal examinations are made or pads are changed. Hands should be washed in antiseptic solutions before each application of vulva pads.

8. During the late winter and early spring months all staff members should use antiseptic nose and throat washes.

9. During this season also all visitors should be masked and not admitted with active colds.

10. If an epidemic occurs, all carriers should be found at once and relieved from duty. If the epidemic does not stop in five or six days, the hospital should be closed.

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A BACTERIOLOGIC STUDY OF THE PUERPERAL BLADDER*

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BACTERIOLOGIC studies of the bladder in children and in pregnant women have been reported frequently in recent medical literature, likewise numerous experimental studies on animals. There has been apparently no work on the puerperal bladder, however. This investigation was undertaken to determine whether the puerperal bladder contained bacteria, and if so, to study and classify them according to types.

Bacteria are known to cause many pathologic conditions in the urinary tract of which pyelonephritis, pyelitis, cystitis and various combinations of the above are the most common. While the bacteriology of these has been studied extensively, few observations have been made on the bacteriology of the normal bladder. It has been shown[1] that typhoid and other organisms may be excreted in enormous numbers under certain circumstances without clinical evidence of damage to the urinary tract.

The importance of bacteria in the urine in diseases of the urinary tract has been emphasized by many workers. If bacteria are found in the normal puerperal bladder, then the isolation of organisms in pyelitis, cystitis, or pyelonephritis is of less etiologic and diagnostic value

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than is generally believed. Some information may also be elicited regarding the danger of repeated catheterization of the puerperal bladder producing catheter cystitis if a careful technic is followed.

The relation of bacteria to pyelitis of pregnancy is well known. Many clinical studies on the etiology of pyelitis of pregnancy have been reported during the last ten years, and much experimental work done to establish the exact mode of infection. Falls[2] in reviewing the literature found two main theories as to the pathogenesis; the French school believes that infection of the pelvis of the kidney occurs via the blood stream. The German school considers pyelitis as an ascending infection which occurs along the lumen of the ureter. Mackey[3] in addition to these two theories stresses the possibility of transparietal infection by way of anastomosing lymphatics of the colon or bladder and the lymphatics of the kidney.

Although not accepted by all workers, there has been considerable evidence advanced which favors the theory that bacteria can and do travel up the lumen of the ureter and set up an inflammation in the pelvis of the kidney. Cabot and Crabtree[4] claim that no clinical or experimental evidence has been advanced that would support the ascending theory. Goldfadder[5] favors the hematogenous theory. Eisendrath and Schultz[6] conclude from experimental and clinical data that the lymphatic system carries the infection unless the ureters are almost completely blocked. Widal and Bernard[7] believe pyelitis is essentially a bacteremia. Eisendrath and Kahn[8] and Walker[9] studied the lymphatics in animals first infecting the bladder and then making serial sections of the periureteral lymphatics. They both conclude because of round-celled infiltration and evidences of mild infection that the pelvis is infected by the lymphatic channels.

V. C. David[10] believes that the infection can ascend up the lumen of the ureter and is able to produce an ascending pyelitis in dogs. He concludes that extension will take place with only slight obstruction to complete emptying of the bladder. Curtis[11] states that organisms may ascend from an infected residual urine up the ureters and produce a pyelitis. Williams[12] speaks of a cystitis which may ascend the ureters and cause either a pyelitis or pyelonephritis.

Wislocki and O'Conor[13] working with rabbits showed that regurgitation of fluid up the ureters was possible if the bladder was first moderately distended. A solution of methylene blue was injected into the bladder until distended and the ureters examined. They found that in some cases the peristalsis was insufficient and the fluid would ascend to the pelvis of the kidney. Hundley[14] states that when tried on dogs the results are less striking, so that we do not know that regurgitation would be as simple in the human as in the rabbit. However, Kohrer quotes Volker[15] as having shown that collargol injected into the human bladder can be detected in the pelvis shortly after. He explains this by assuming that antiperistalsis is set up in the ureter due to irritation.

McDonald[16] has described the patulous flattened "golf hole" ureteral orifice found in certain pregnant women, and considers the condition to be due to the stretching of the intraureteral bladder ligament by the growing cervix of the pregnant uterus. The author believes infection may ascend up such ureters.

Koll in discussing a paper on pyelitis by Crabtree and Cabot[17] suggests that bacteria are excreted by the kidney without clinical evidence, a latent condition lasting from infancy and that pyelitis of pregnancy is an acute exacerbation due to

pregnancy as the predisposing cause. He contends that 90 per cent of all women give histories of "kidney trouble" in childhood which he interprets as pyelitis. Falls[2] also suggests such a possibility.

Beeler and Helmholz,[18] however, found that in girls over two years of age the urine was almost always free of organisms and entirely free of those belonging to the so-called colon group. Langer and Soldin[19] state that they were able to isolate streptococcus lacticus in every one of the 138 patients they examined when repeated cultures were made. Hartshorn[20] states that in one-half of the healthy children the urine is free of bacteria.

The bladder as a possible source of puerperal sepsis must be considered in certain cases especially when large numbers of organisms are found in the urine. However, it has been shown[2] that puerperal sepsis does not necessarily follow bacteriuria. Catheterization of such cases would be a step in understanding such infections when they do occur.

Several cases of toxemias of pregnancy were observed by the author to determine if there were variation in the bacterial content of urinary tract from the normal puerperal bladder.

Authorities differ concerning the bacterial content of the normal bladder. Crabtree[21] stated in 1916 without giving data that the urine contains many types of organisms, most of which were nonpathogenic. Hale-White[22] reported results on fifty-six nonpregnant women all of whom were in the hospital with extraurinary affections. All of these women had sterile urine when carefully examined and inoculated on culture media. He stated, however, that it is commonly believed that Bacillus coli are frequently found in urine of pregnant women. He felt that further investigation was necessary before conclusions could be drawn. In a later article[23] (1922) he also repeated this statement but gave no data. Williams[24] catheterized 70 women, 44 of whom suffered from long standing intestinal disorders. Sixteen of these 44 cases showed Bacillus coli in the bladder urine. Of the remaining 26 cases that gave no history of constipation there were none that harbored any of the colon group. Albeck[25] in 1907 stated that of 392 pregnant women catheterized in L Meyer's Clinic in Copenhagen, bacteria were found in 8.16 per cent.

Hewitt[26] reports three series of cases. In the first series Panton catheterized 100 women comprising various extraurinary conditions and found 18 per cent sterile. Of the organisms Staphlococcus albus occurred in 62 per cent of the number, Bacillus coli in 7 per cent, Bacillus proteus in 6 per cent, other coliform organisms in 1 per cent. Gough catheterized 100 females in the hospital for gynecologic conditions and found 30 per cent sterile. In this group 56 per cent had Staphlococcus albus and 12 per cent Bacillus coli. A third series by Hewitt comprising 100 females who were pregnant, of which 32 per cent had sterile urine. Staphlococcus albus was present 35 per cent and Bacillus coli in 30 per cent. He concludes that staphlococci predominate in normal urine and that catheterized specimens are rarely sterile. Keene discussing a paper by Vaux[27] says that bacilluria is very common in pregnancy.

Engelhorn[28] examined the urine of 35 pregnant women and found it sterile in 14. In 10 of the 21 in which organisms were found there were symptoms of cystitis. The remaining 11 had no signs of an infection other than bacteria in the urine. Falls[2] reports 10 patients all pregnant, having no signs or symptoms of bladder infection. These women voided spontaneously and were then catheterized

immediately and the residual urine examined and incubated on culture media. Six of the ten cases showed organisms, Bacillus coli in all cases and Staphlococcus albus in symbiosis in four of the six. The remaining four were sterile.

Danforth[29] catheterized 50 normal pregnant women and found a pure culture of staphlococci in 32. Two cases showed a pure culture of Bacillus coli and three a mixture of Staphlococcus albus and the colon bacillus. The remaining 13 were sterile. In a second series 14 women were catheterized after being prepared for delivery. Eight of these grew staphococci and one had an anaërobic growth not named. All of the first series and a majority of the second were catheterized by a nurse.

It would appear from this review that there are bacteria in the bladder of normal women, both the pregnant and nonpregnant. The organisms most frequently recovered are staphylococci and Bacillus coli. There is no apparent reason why the bacterial flora of pregnant and nonpregnant women should differ.

Two series of cases will be reported. The first consists of 51 puerperal women who had not been catheterized previous to or at delivery. The second series of 7 who had been catheterized incidental to delivery and this first specimen not saved.

Procedure.—Each case was carefully catheterized three times at intervals of forty-eight hours. The first specimen was obtained about twenty-four hours after delivery. No cases were included where, because of tenderness or swelling of the genitalia, contamination of the specimen was likely.

The first five cubic centimeters were allowed to drain through the catheter and discarded. Beeler and Helmholz[18] collected their specimens in three tubes considering the first portion as urethral. This first portion cannot be representative of the bacterial flora of the urethra because of mechanical reasons. A few organisms may enter the catheter as it is inserted into the bladder and it was to avoid such contamination that we discarded the first portion. The next thirty to forty cubic centimeters of urine was then collected in a large sterile centrifuge tube. The tubes were centrifuged for ten minutes at approximately eight thousand revolutions per minute to sediment the bacteria if present. A routine urinalysis was run in addition to the bacteriologic tests and the results are shown in Table I. One loop of the sediment was examined in the hanging drop to determine motility of the bacteria if present. A second portion was examined in a direct stained smear using Gram's method. A third portion was plated out on blood agar, two plates being used for each sample. The first plate we streaked out one loopfull (which is approximately 1 cubic millimeter) while for the second we plated out five cubic centimeters of urine.

Crabtree[21] has rightly emphasized the importance of stained smears of centrifuged urine. He found that by carefully examining centrifuged specimens he could correlate these results with innoculations in every case. We found that our smears agreed with results of inoculation in 96.15 per cent of the cases in a total number of 156 smears examined.

There are certain risks in catheterizing a puerperal case three times in six days. Williams[30] states that no matter how carefully performed, catheterization carries with it a certain danger of cystitis. Luetsche[31] considers catheterization a very serious procedure especially when local conditions such as trauma following labor, etc., are present. Besides determining the frequency of catheter cystitis the second and third specimens enable one to determine whether or not organisms are forced in to the bladder by catheterization, and indirectly it will determine the flora of the urethra

if organisms are forced in. Day[32] however, states that catheterization of the healthy bladder will cause cystitis only when there is a retention of small amounts causing residual urine or retention with distention. He further states that introduction of pyogenic organisms into healthy bladder will not cause cystitis even with considerable trauma provided there is no distention or residual urine.

Meat infusion blood agar plates were used since they meet practically all the requirements for such work. McKinzie and Cochrane[33] used liquid media in which to incubate the urine and Langer and Soldin[19] report using liquid culture media.

The advantages of solid media are that isolated colonies of various bacteria may be distinguished and that one can determine the relative number of organisms present in the specimen.

Results.—Of the 51 cases reported only four had organisms at the first catheterization, 92.16 per cent being sterile. Twenty-five cases or 49 per cent were sterile on all three occasions. This means that 51 per cent of the cases that had sterile cultures on the first catheterization remained sterile for the two subsequent. Four cases had sterile cultures for the first two samples but showed organisms in the last specimen taken on the fifth day postpartum.

TABLE I

		PER CENT
Number in series	51	
Number sterile three times	25	49.0
Number showing bacteria	26	51.0
Number showing bacteria first	4	7.8
Number showing bacteria second	18	35.3
Number showing bacteria third	4	7.8

Of the four cases showing bacteria on the first inoculation one grew a pure culture of Staphylococcus aureus, one grew a pure culture of a gram-positive bacillus of the diphtheroid group. The other two patients had mixed cultures of Staphylococcus albus and diphtheroids. One of these had fever and tenderness over the abdomen and was diagnosed perimetritis. Later (on fifth day) when the third specimen was obtained the urine was sterile. This is the only instance of this finding in the series. All symptoms had disappeared in the interim.

Table II gives the strains of organisms found and the number of times isolated.

TABLE II

ORGANISM	TIMES ISOLATED
Staphylococcus albus—pure culture	14
Diphtheroids—pure culture	13
Both in symbiosis	14
Staphylococcus aureus	1
Neisseria catarrhalis	3
Streptococcus lacticus	2 (same case)
Bacillus coli	2 (same case)

Apparently delivery from above by cesarean section, which minimized the influence of bladder trauma, does not influence the results, for in two of the women in Series I the urine was sterile at first catheterization with organisms present in subsequent specimens.

One case developed eclampsia but had no organisms on first catheterization. The second and third specimens did show a pure culture of Staphylococcus albus. Two other cases developed definite signs of preeclamptic toxemia and one apparently had a nephritic toxemia. All were sterile with the first specimen showing organisms on the third and fifth days postpartum when the other catheterizations were done.

Series II. Here the procedure and technic were identical except that the first specimen was not available for culture and the first one recorded is the second catheterization. In all these specimens organisms were found except in one. Table III shows the organisms recovered.

TABLE III

PATIENT NO.	CATHETERIZATION		
	1	2	3
1	Staph. albus	Staph. albus	Staph. albus
2	Staph. aureus	Staph. aureus	Staph. aureus
3	Staph. albus	Staph. albus	Staph. albus
4	Bacillus coli	Bacillus coli	Bacillus coli
5	Sterile	Staph. albus	Staph. albus
6	Diphtheroids	Staph. albus	Staph. albus
7	Diphtheroids	Diphtheroids	Diphtheroids

None of the 58 women studied in both series developed cystitis or any symptoms referable to infection of the urinary tract.

Out of 177 specimens plated out, the colon bacillus showed up in only five plates and three of these on one case which had previously been catheterized by a nurse because of retention. The other two times it appeared was in the second and third catheterization of a case which we had previously found sterile urine. Only two cases, one in Series I and one in Series II showed Bacillus coli in their bladder. In other words out of 58 women examined only 3.4 per cent of them yielded a coliform organism in the urine. Neither of these women showed any evidence of cystitis.

CONCLUSIONS

1. The normal puerperal bladder in this series was sterile in 92.16 per cent of cases, at the primary catheterization.

2. Subsequent catheterizations yielded positive cultures in 51 per cent of cases. No symptoms of cystitis were noted in these patients.

3. There is relatively little danger of catheter cystitis when catheterization is carefully performed.

4. The organisms recovered in this series were relatively nonpathogenic, Staphylococcus albus, Diphtheroids, and Streptococcus lacticus.

5. The colon bacillus is rarely found in the normal puerperal bladder.

6. The type of organisms found suggest the probable nature of the bacterial flora of the urethra.

7. The finding of the colon bacillus in women during pregnancy or the puerperium suggests the possibility of pathology in the urinary system, particularly pyelitis.

8. The puerperal bladder following the two cases of cesarean section yielded the same results as those delivered from below.

9. The few cases of toxemias of pregnancy which we studied gave similar results to those who had a normal pregnancy and puerperium.

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1625 MAIN STREET.

SOME OBSERVATIONS BASED ON ROUTINE INVESTIGATION OF THE KIDNEYS IN THE TOXEMIAS OF PREGNANCY*

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OF ALL theories advanced concerning the causative factors of the toxemia of pregnancy, none has a greater appeal than deranged kidney function, interpreted in its broadest sense. In fact, the rôle of the urinary organs in a toxemia of pregnancy is always of the utmost importance. My own confidence in these premises prompted the investigations I desire to report herewith. In a review of the literature, it is evident that numerous investigators concur in these views, both from studies in vivo and in the postmortem laboratory. Prutz, in a collection of 360 autopsies after eclampsia, found renal involvement in all but 7 cases. Pollack, of Vienna, confirmed these findings and noted renal involvement in 98 per cent in a series of 139 cases. Bugbee states that the frequency of renal infections in pregnancy is not generally appreciated and expresses the belief that the process is hematogenous and originates in the colon.

For the sake of simplicity and brevity it is well to divide the toxemias of pregnancy into the early and late. In the early cases are included those of pernicious vomiting, and in the late the eclampsias. Conceding that some women go through pregnancy wtihout discomfort, while others are miserable, the fact that there must be something circulating in the maternal blood responsible for the untoward symptoms cannot be disputed. I believe that this is a toxin originating in the kidney primarily and distributed by the blood stream. I have had an opportunity to investigate and treat 52 cases of toxemia, and the end-results have been so striking and gratifying that I have made a routine investigation in every case of pregnancy presenting the slightest evidence of toxemia.

A case was regarded as one of mild toxemia when there was persistent nausea and vomiting except for the retention of fluids, with stationary or slight loss of weight. If allowed to progress, such patients may reach the stage of hyperemesis gravidarum. Many cases of mild toxemia have been said to show normal urinary findings, yet when a complete investigation is made, the findings are really abnormal. All patients in this series manifested an increase in blood pressure, ranging from 30 to 100 mm. of mercury. Four of these women were comatose and well-advanced in their pregnancy, and when first seen presented the picture of profound uremia. Nevertheless, they

*Read before the Harlem Medical Association, New York City, December 7, 1927.

responded promptly to the remedial measures applied, and three of them went to term and were delivered of living babies.

All patients in this series of cases who developed any elevation of systolic blood pressure as compared with the reading at a previous examination, even though without other symptoms of toxemia, were subjected to the following routine investigation of the urinary tract; the same measures were also applied to those with mild or severe toxemia.

1. A careful history concerning a possible renal or other urogenital involvement in infancy, puberty, or adolescence, or following abortion, operation, etc.
2. Careful analysis of specimens of urine, taken both day and night.
3. Cystoscopic examination of the bladder.
4. Passage of catheters into both ureters at separate sittings, to exclude obstruction within the ureters by stone or stricture, or obstruction by extrinsic pressure.
5. Collection of urine from each side for evidence of pyelitis or pyelonephritis (macroscopic and microscopic investigation as well as a pus cell count).
6. Culture of these specimens for staphylococci, streptococci, colon or tubercle bacilli.
7. Renal function tests: indigo-carmine or phenolsulphonephthalein.
8. Pyelographic studies whenever indicated.

An examination that includes all of these details upon the faintest suspicion of toxemia in early pregnancy, will provide a wealth of valuable information. In fact, it is the early discovery of renal or ureteric alterations that offers most in the prophylaxis of the toxemias. A catheterized specimen of bladder urine rarely yields sufficient information, as pus cells are often mistakenly attributed to a cystitis.

After the urine has been collected from each kidney, it should be inspected macroscopically for turbidity, mucous shreds, flakes, and débris. Microscopically, the examination should include a search for bacteria, epithelial cells, pus cells, and in acute cases, red blood cells. It is well to make sure, however, that the red cells are not due to the trauma of the catheterization. In cases of pyelonephritis or those with other renal parenchymal disease, hyaline and granular casts, besides the albumin and pus, will be found as evidence of such involvement. Directly proportionate with the degree of renal parenchyma, the elimination of indigo-carmine will be delayed after intravenous injection.

Of the 52 cases studied, 40 showed turbidity of the urine in catheterized specimens taken from one or both kidneys. This turbidity was not dissipated by heat, and the gross appearance of the specimens revealed flakes, shreds, or débris. Microscopic examination disclosed the presence of pus cells, epithelial cells, numerous shreds, and various cocci and bacilli, and hyaline or granular casts. The right side was affected in 22, the left in 16, and both in 8 cases. Clear specimens, suggestive of no gross renal pathology, were obtained in 6 cases. Cultures were made of all urine specimens. The colon bacillus predominated, being found in 24 cases, the staphylococcus in 7 cases, and

the streptococcus in 5 cases; mixed infection occurred in 9 cases (colon bacilli and staphylococcus); the Bacillus proteus was found in 1 case; cultures were negative in 6 cases.

Complicating pathologic conditions were found in several cases. Ureteral stricture occurred in 5 (3 on the right and 2 on the left side); stone in the pelvis or ureter was discovered in 3; hydronephrosis was found in 2 and pyonephrosis in 3 cases; and there was ptosis of the kidney and kinked ureter in 2 cases. Pyelitis was differentiated from pyelonephritis by the presence of hyaline and granular casts in the urinary sediment of the latter group. In the 6 cases that did not present urinary abnormalities and showed negative cultures, and in whom there was persistent nausea, vomiting, etc., 2 patients had a pronounced retrodisplacement, 1 had a severe nasopharyngeal catarrh, 2 were guilty of dietary indiscretions, and 1 had disease of the nasal accessory sinuses. In the 46 cases that showed definite evidence of renal involvement, the indigo-carmine excretion was delayed from 9 to 30 minutes, depending upon the degree of functional impairment. In 2 cases there was no elimination of dye at the end of two hours. Pyelographic studies were only made in cases in which stone, dilatation of the renal pelvis, hydronephrosis, or pyonephrosis were suspected.

After the diagnostic measures I have outlined were carried out and the renal lesion determined, treatment was instituted. A urinary antiseptic was given by mouth. Caprokol in full doses proved to be efficacious in many cases. Some of our clinic patients complained of the expense of this drug, so effervescent granules of formohydrion (Merck) were substituted. This was given in teaspoonful doses in a tumblerful of water every four hours with excellent results. The free ingestion of water was encouraged as soon as vomiting began to lessen. Water is preferably given in small quantities at frequent intervals. Special attention was directed to constipation, but drastic cathartics were never used. All patients were given colonic irrigations. Corpus luteum extract, insulin, glucose, liver extract, calcium, and placental extract were not prescribed at all.

In every case a careful search was made for a focus of infection in the teeth, tonsils, sinuses, and cervix. Some patients were benefited considerably by injections of autogenous vaccines, made from the kidney urine cultures, but the most important therapeutic procedures were the local measures directed to the kidney itself. These consisted of irrigating the renal pelvis and dilated calyces, by means of a double catheter, using boric acid, 2 per cent, saline or sterile water. Lavage of the renal pelvis was repeated until the fluid returned clear, after which from 5 to 10 c.c. of neosilvol, 5 per cent, mercurochrome, 1 per cent, or silver nitrate, 2 per cent, were instilled into the renal pelvis. I prefer neosilvol as it does not stain, or irrigate the tissues. Mercurochrome may discolor the urine red and alarm the patient. Silver

nitrate precipitates the chlorides in the urine, and soon loses its effect. The irrigations and instillations were repeated every fourth or fifth day, depending upon the severity of the case.

In eight cases indwelling catheters were left in the ureters for several days until satisfactory drainage was established. It is very important to irrigate these catheters carefully to insure continuous drainage, as they may become plugged. In those cases in which there was an acute exacerbation of a chronic inflammation, such as acute congestion, edema, swelling, etc., no local treatment was applied until the acute process had subsided. Often within forty-eight hours after the insertion of an indwelling catheter, the general symptoms improved. At the first sitting a No. 5 F. catheter with a whistle tip was used. In some instances the suppuration was so severe that there was no drainage from one side, although normal urine came down the other, thus making it appear that the output of urine was normal. As the patients improved and the urine cleared, catheterization was done once a week. As the renal involvement abated, the toxemia and hypertension diminished. After the patient was symptom-free, the ureter was dilated as a terminal measure to prevent the formation of an inflammatory stricture and obstruction of the renal pelvis.

In most of the cases treated there was a coincident cystitis, and the bladder was also treated by intravesical irrigations or instillations, using the silver salts, mercurochrome, or acriflavine. The necessary special procedures were of course utilized for the treatment of strictures and calculi.

In 6 cases I had expected to do a therapeutic abortion for toxemia, but the patients went to term and were delivered of viable children, 5 of whom are now alive and well.

CONCLUSIONS

1. The kidney of pregnancy appears to be an important etiologic factor in the toxemias of pregnancy. This kidney is usually one that has been previously affected in childhood, puberty, or adolescence, or has become secondarily involved from extraneous foci of infection.

2. A careful routine study of the kidneys in pregnancy will offer a solution of the problem of toxemia in many cases.

3. Routine catheterization of both ureters should be done in all cases of pregnancy manifesting an early toxemia, or arterial hypertension without symptoms of toxemia. Every obstetrician can easily acquire the technic of cystoscopy, as cystoscopy in the female is not difficult.

4. Many patients previously referred to the obstetrician for the instrumental termination of pregnancy can be safely carried to term, if a definite renal or ureteral involvement is found and adequately treated.

801 West End Avenue.

A CASE OF PYOSALPINX CAUSED BY OXYURIS VERMICULARIS COMPLICATED BY TORSION OF THE OVIDUCT*

By William Sidney Smith, M.D., F.A.C.S., and James Denton, M.D.
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(From the Department of Gynecology and Obstetrics of the Brooklyn Hospital)

THIS case is presented on account of the rarity of the condition, the unusual clinical manifestations, and the distinctive lesions found.

A twenty-three-year old, white, single, nullipara, a stenographer by occupation, was admitted to Brooklyn Hospital on November 29, 1927. She had been well and had worked regularly until October 1, 1927. Her menses had always been regular and painless. On October 1 she first noticed pain in the right lower abdomen. This was worse when standing and became so much worse in a few days that she was unable to work.

She consulted her family physician who ordered her to bed and applied an ice bag to the abdomen. The temperature at this time was only slightly elevated. The physician made a pelvic examination and felt a mass in the right broad ligament and a smaller one on the left side. Rest in bed relieved the pain considerably. The menses occurred at the proper time, October 18, but lasted two weeks.

The patient first came under observation on November 27, 1927, six weeks after her first attack of pain. She was pale and thin, but not acutely ill or confined to bed. No abnormal physical signs were elicited in her chest, no masses were palpable on abdominal examination, but the lower part of the abdomen on the right was tender. Vaginal examination showed a tight two-finger introitus. The cervix was slightly eroded. The uterus was in an anterior position and pushed over to the left side of the pelvis. The right side of the pelvis contained a large cystic mass which was acutely tender and not readily movable. The left adnexum did not appear enlarged (an error in palpation). There was no gross evidence of gonorrheal infection. Smears from the cervix and urethra did not contain gonococci. The patient was intelligent and cooperative and denied ever having had gonorrhea but admitted having had sexual intercourse. Operation was recommended but, as the pain was subsiding, it was thought best to defer the operation until after the next menses. The provisional diagnosis made at the time was ovarian cyst, with a twisted pedicle. The next menses were on November 5, they lasted five days and were normal in character. Three days after this ended, the patient came to the hospital for operation.

On admission, the pulse, temperature, and respirations were normal. Blood pressure, 130/80. The urine was normal. Hemoglobin 85 per cent. Red cells 4,400,000, white cells 9,700, polymorphonuclears 60 per cent. The Wassermann reaction was negative. Physical examination of the chest and abdomen showed nothing additional. The vaginal examination yielded the findings previously stated.

Operation.—The abdomen was opened in the median line below the umbilicus. The right tube in its outer two thirds was greatly distended, cystic, and adherent

*Read at a meeting of the New York Obstetrical Society, February 14, 1928.

to the uterus and intestines. The inner third of the tube was small, flat, and completely twisted on itself from right to left. The left tube and ovary were much enlarged and adherent to the left side of the uterus and to the intestines. The uterus was small and in an anterior position. The peritoneum and external surfaces of the tubes were examined for tubercles but none were found. The process was looked upon as gonorrheal in origin. The uterus was removed supra-

Fig. 1.—Right oviduct dilated and filled with puriform material. The left oviduct and ovary fused in a mass of inflammatory tissue.

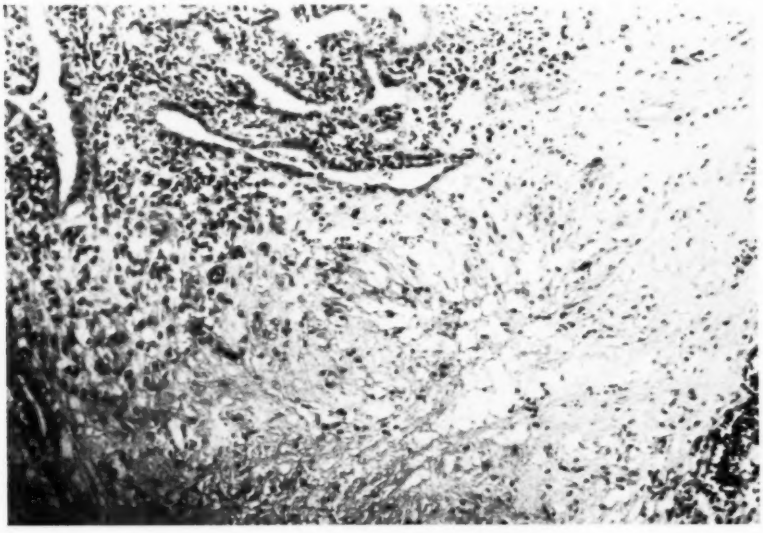

Fig. 2.—Margin of an area of anemic necrosis in the wall of the oviduct.

vaginally with the left tube and ovary and the right tube and the appendix. The right ovary was left in its dense bed of adhesions. All the adhesions were very dense and old. The left tube was ruptured in removal. The pus from the tube yielded no growth on culture media. The cervix stump was split and vaginal drainage instituted. The abdominal wound was closed without drainage except for a small bit of rubber tissue in the fat layer. Convalescence was uneventful and the patient left the hospital on the twenty-first day after the operation. On

discharge, the abdominal wound had healed by primary union. The pelvis was free from exudate, but there was still some discharge from the split cervix.

The patient regained her strength rapidly after leaving the hospital and returned to her regular work in one month.

Examination by Dr. Denton of the left oviduct showed that its increase in size was due to an extensive inflammatory process in the wall of the tube. The major share of the thickening of the wall was due to infiltration of the mucous membrane and submucosa by cells of the lymphocyte order, to large mononuclear cells and to fibroblastic reaction. Foreign body giant cells were very numerous. The puriform material observed grossly was not pus but a product of anemic necrosis which contained no polynuclear leucocytes. In all the microscopic preparations the thin shells of small, round worms were found. In places the sections passed through the central parts of the bodies of the worms and in others through the thinner ends of the parasites. From the size, shape, and thickness of the

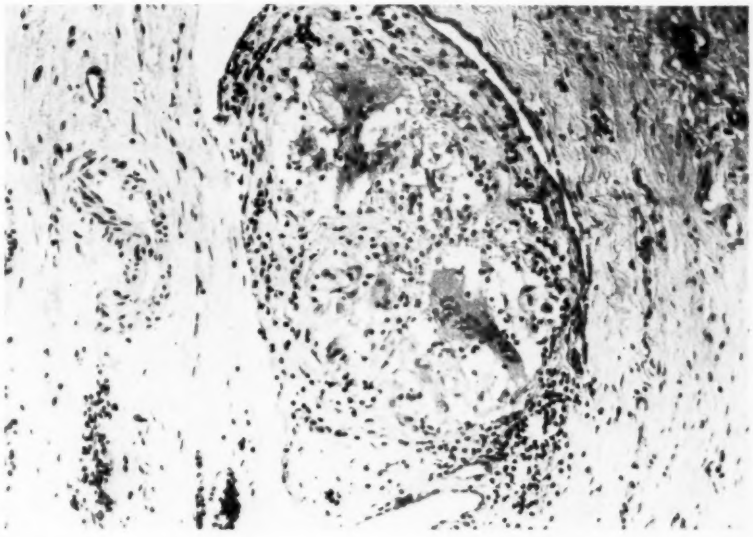

Fig. 3.—Foreign body tubercle at one end of an Oxyuris vermicularis.

body walls of the worms they were considered to be Oxyuris vermicularis. About all the worms there was a very marked foreign body reaction with large multinucleated giant cells about the parasites. The body shells gave a microchemical reaction similar to that given by chitin. A careful search of the sections revealed no identifiable ova.

The central softening of the tube appeared clearly to be due to anemic necrosis caused by gradual devascularization of the inflammatory products in the wall of the tube.

The histologic details were not dissimilar to those produced by tuberculosis in the oviduct except that no small, typical tubercles were found. The anemic necrosis gave an appearance very similar to caseation and numerous focal areas were found which resembled reticulated tubercles.

After finding these unusual parasites in the mucous membrane of the tube, the stools were carefully examined for parasites and ova, but none were found.

The blood showed no increase in eosinophile cells. A small amount of pus from the vaginal discharge was injected into a guinea pig and the pig was killed later, but no lesions were found.

Comment.—The case is of unusual interest on account of the unusual etiology, the complicating torsion of the oviduct and on account of the

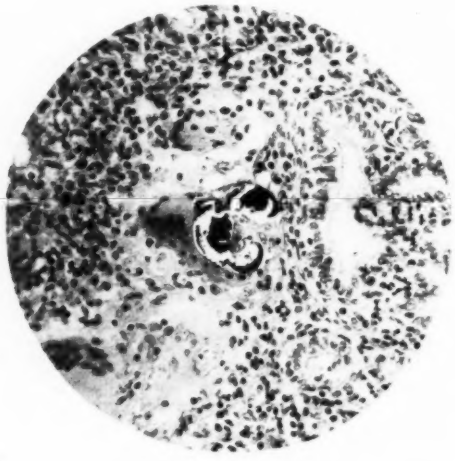

Fig. 4.—Foreign body giant cell forming about Oxyuris vermicularis in the submucosa of the oviduct.

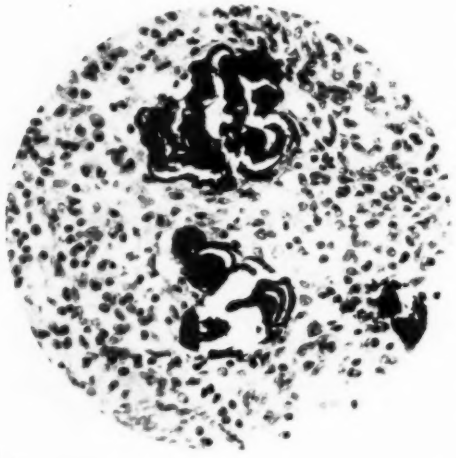

Fig. 5.—Section passing through the body and extremity of Oxyuris vermicularis in the submucous stroma of oviduct.

brief duration of the subjective symptoms. It is unusual that such pronounced pathologic changes should occur in an apparently healthy young woman without earlier and more pronounced subjective symptoms and with such insignificant menstrual disturbance. The conditions in the adnexa were unquestionably of long duration as the

density and toughness of the adhesions would indicate. In all probability, the torsion of the oviduct began before the pyosalpinx reached such massive proportions and became more exaggerated as the size increased.

Casagrande[1] has recently reported a case of torsion of the oviduct and cites the work of Darnell, Anspach, Payr and Smith and Butler to show that torsion of a normal tube is of rather rare occurrence, whereas in pathologic tubes it is relatively more common.

Finding the nematode worm and the fairly distinctive reaction induced by the parasite, prompted us to refer to the literature relative to the subject. The last case of Oxyuris in the oviduct was reported by Tschamer[2] in 1919. He gives a review of the literature for many years previous to that time and includes an extensive list of references. He describes his own case of Oxyuris in the tube, refers to that of Schneider[3] in 1902 and of Giovanni Marro[4] in 1901.

Tschamer states that Oxyuris is not an entirely harmless parasite, being able to penetrate the wall of the intestine, to cause appendicitis and to induce inflammatory changes in the tissues in which it lodges. The worms have been frequently observed in the female genital tract, wandering into the cervix, uterus, and tubes. He thinks the condition is more common than the reported cases would indicate. He cites the case of Simmons in 1899 in which the parasites were found in the cervical secretion, and that of Chiari in which they were found in a saeule in the wall of the pouch of Douglas.

In Tschamer's case the uterus was completely removed on account of a cervical chorioepithelioma and the Oxyuris was found free in the lumen of the tube by the pathologist.

Schneider removed the whole uterus in his case on account of a bilateral pyosalpinx. The patient died of peritonitis, and a nodule 2 mm. in diameter was found in the stump of the ovario-pelvic ligament at autopsy. The nodule was found to contain an adult, female Oxyuris and innumerable ova.

Giovanni Marro discovered Oxyuris in the wall of a tube at autopsy but no statement was made as to the cause of the individual's death. Here again, a nodule was found on the surface of the oviduct and the Oxyuris was identified in the nodule, microscopically.

Rheindorff[5] believes Oxyuris requires blood for its existence and that it penetrates the mucosa in quest of food.

Tschamer accepts Merten's[6] idea that Oxyuris carries pathogenic bacteria with it, and that these may provoke ascending, inflammatory processes. He rejects Simmon's proposal of a parasitic endometritis, *sui generis*, caused by Oxyuris. He regards salpingitis due to this cause as very unusual and concludes that it should not be considered as a pathologic entity. He publishes his case as a rare, medical curiosity.

We are inclined to regard the changes produced in the oviduct as quite analogous to those produced by the tubercle bacillus in the same organ. The histologic changes in the tube are clearly of a type attributable to a weak injurious agent and assumption of secondary bacterial infection does not appear necessary.

It is quite likely that the condition has been confused with tuberculosis of the oviduct as the histology in some areas is sufficiently similar to render this error readily possible.

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370 Washington Avenue.

(For discussion, see page 290.)

TORSION OF THE FALLOPIAN TUBE, WITH THE REPORT OF A CASE PRODUCING ACUTE GANGRENE OF THE TUBE

By Marion Douglass, M.D., Cleveland, Ohio

(From the Department of Gynecology, Western Reserve University School of Medicine, and The Lakeside Hospital)

TORSION of the fallopian tube which has already become the site of some preexisting lesion is not an extremely uncommon occurrence. The fact, however, that this condition is practically never diagnosed clinically, justifies consideration of this case.

Primary torsion of a normal tube is an extremely rare condition and a consideration of tubal structure and attachments would suggest that in all cases in which this accident occurs there is an underlying pathologic factor. (Thorek.) It is often very difficult to be certain after torsion has occurred whether or not the tube was entirely normal previously. Hematosalpinx is the common finding in cases in which torsion takes place and it is impossible in many cases to assure one's self that the hematosalpinx found at operation was not a preexisting hydrosalpinx, as true in this case.

Darner was able to find six authentic cases only of torsion of an unquestionably normal tube. The lesion was described by Bland-Sutton in 1891. Anspach collected 95 cases, most of which showed an inflammatory tubal lesion as an associated factor, and which probably should be construed as the inciting cause of the disease.

Our own case was undiagnosed as there was nothing in the clinical history except the very acute character of the pain which suggested any other lesion than acute salpingitis.

Mrs. D. K., aged thirty-five, para iii, entered the Lakeside Hospital on July 22, 1927, complaining of pain in the lower abdomen which had gradually increased over a period of three days. The patient had one child, aged seventeen years, living and well. She had had two miscarriages, one preceding and one immediately following the birth of her child. She had had a single attack of appendicitis and had an appendectomy in 1917. Her past history was otherwise entirely negative.

Her present illness began two weeks before her admission with cramp-like pains in the right lower quadrant and in the midline. She also had marked backache.

She had severe chills and felt feverish. The pain becoming tremendously acute and lancinating the day before admission, she was admitted to the accident ward, fourteen days after the beginning of her illness.

Her menstrual periods were normal and she had profuse leucorrhea. Physical examination was negative except for the abdomen which was markedly tender in the right lower quadrant, and on pelvic examination there were bilateral adnexal masses. Her temperature on admission was 38.5°. W.B.C. count was 14,000. Urine examination was negative. The diagnosis was acute exacerbation of a chronic salpingitis. The patient was treated expectantly for eight days, after which her temperature was normal and W.B.C. count was 10,000. On pelvic examination at this time there was found a relaxed outlet and there was marked leucorrhea

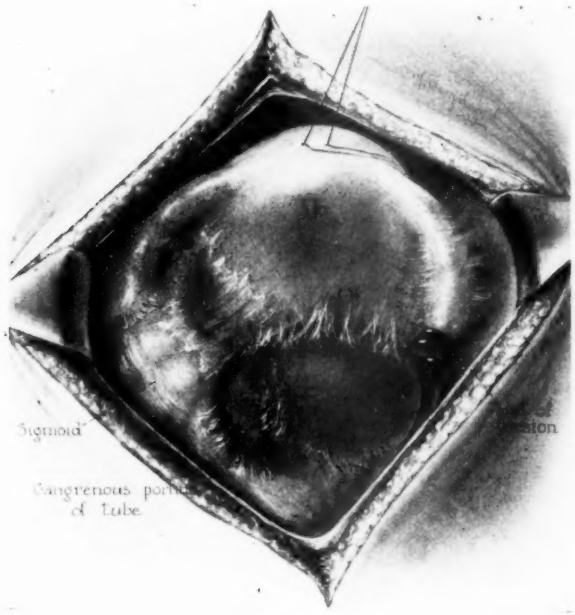

Fig. 1.

The cervix was lacerated. The uterus was anterior, about normal in size and hard. There was a large, soft, cystic mass, suggesting a hydrosalpinx, posterior to the uterus and approximately the size of an orange.

Laparotomy was performed and the pelvis was found to be obscured by adhesions of the omentum which were separated and a large dark cystic structure was found posterior to the uterus filling the entire culdesac. This was finally identified as being the right tube. The mass was apparently gangrenous, it being dark red, and in various areas entirely black. The tube was gradually freed by careful sharp dissection and the adhesions to the sigmoid and the bottom of the culdesac separated slowly. The left tube was closed at the fimbriated end and filled with seropurulent fluid. Smear showed a mixed infection of streptococci and bacilli.

We were unable to account for the dark color and gangrenous appearance of the right tube until after removal of the adherent omentum, examination showed that the tube was twisted three times upon itself, almost having twisted itself off at a point almost at the junction of the proximal and middle thirds. This was

obviously the cause of a moist gangrene. A hydrosalpinx had become twisted upon itself several times and became necrotic, forming adhesions in the pelvis in every direction. The fimbriae were destroyed and the tubal end sealed off completely. Infection was as yet limited to the immediate vicinity of the tube. Micropathologic diagnosis showed acute necrosis of the right tube with total loss of structure. The lumen was filled with blood clot and the endosalpinx was entirely destroyed. The left tube was thickened and the fimbriae were closed off. The wall was thickened and edematous and was infiltrated with polymorphonuclear and mononuclear leucocytes. The mucosa was practically intact. The diagnosis was acute exacerbation of a chronic salpingitis. The ovaries were uninvolved and were normal in size and appearance.

The fallopian tube may be considered as predisposed to torsion, due to its position. Having a fixed medial extremity and a lax attachment to the broad ligament and an enlarged fimbriated end, it tends to fall posteriorly and rotate medially which gives it a primary twist which often amounts to 90° rotation. Changes in abdominal pressure incident to defecation, coughing, etc., are constantly changing the position of the tube and may produce temporary torsion. Pregnancy with its attendant changes in abdominal topography is undoubtedly a predisposing factor. It is quite probable that menstruation, with its increase in congestion, plays a part as an attendant cause. The influence of stasis and venous congestion as a cause for torsion has been emphasized by Payr. He holds that venous stasis causes pressure changes in the pedicle which may produce torsion of a viscus. The size and number of veins in the mesosalpinx and the frequency of swelling and congestive changes in the adnexa due to uterine prolapse or misplacement, causing partial obstruction of these thin-walled vessels, makes this seem plausible. External violence and blows on the abdomen have been reported as preceding the acute abdominal attack which proved at operation to be acute torsion of the tube but their influence is somewhat problematical. Anatomic anomalies such as an abnormally long mesosalpinx or enlarged hydatids of Morgagni may reasonably be responsible for preventing a tube which has been kinked or twisted from freeing itself by acting as a mechanical drag or impediment to the normal mobility of the tube. Darner emphasizes the importance of rhythmic contractions of the tube which may possibly produce the conditions necessary to torsion by changes in venous pressure.

The fact that in all reported cases the incidence on the right side is approximately three times greater than on the left is due either to the fact that the right side of the pelvis is more roomy, due to the location of the sigmoid on the left, which allows greater mobility, or that the adjacent appendix helps produce the inflammatory changes and light adhesions which predispose to the accident. The initial symptoms are usually violent with severe pain and shock resembling those of ovarian cyst with a twisted pedicle, and where the twist is complete, there

may be all the symptoms of a general peritonitis except that the subjective features, i.e., pain and abdominal distress are out of proportion to the temperature and pulse rate. Differential diagnosis must attempt to exclude all the other acute abdominal conditions.

If the condition is undiagnosed, the tube may disengage itself and the acute symptoms rapidly disappear. The hematosalpinx may, however, rupture, producing dangerous intraabdominal hemorrhage. Necrosis, gangrene, and infection are always likely to occur with the production of a general peritonitis. An absolute diagnosis is impossible in the great majority of cases even after the induction of anesthesia, but inasmuch as the confusing conditions usually call for prompt operation the patient will rarely be subjected to unwarranted surgical therapy. As emphasized by Darner, the opposite tube should be carefully scrutinized where one seems to be involved only, because the predisposing etiologic factors are probably bilateral in distribution.

It seems likely that this patient had a hydrosalpinx which became twisted and because of its unwieldly club-shaped end was unable to disengage itself before engorgement gangrene and necrosis occurred. Had the intensity and violence of the abdominal pain as a dominating symptom received due attention, the condition might have been at least suspected.

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1235 Lakeside Avenue.

OSTEOGENESIS IMPERFECTA CONGENITA*

By Charles A. Gordon, M.D., F.A.C.S., Brooklyn, N. Y.

THIS case of osteogenesis imperfecta congenita is reported because of its rarity and the importance of adding photographs, roentgenograms and tissue reports to the literature. Lovett and Nichols have rejected many cases reported as true cases, but since the introduction of the x-ray, diagnosis has become more certain.

Often improperly called fragilitas ossium, its essential feature is bony fragility with numerous fractures and bendings of the long bones, excessive callus formation, and consequent shortening and alterations in contour.

The presence of preparative changes and indisputable evidence of callus formation is excellent proof of intrauterine fracture. The child

Fig. 1.—Osteogenesis imperfecta congenita showing narrow chest, large abdomen and short legs with angles of deformity.

is usually stillborn, or dies shortly after birth, but often it lives suffering repeated spontaneous fractures. This tendency may persist through life; or disappear after many years. Treatment has been of no avail.

Its etiology is unknown. Endocrine disturbance is thought by some to be the cause, but this is a pure hypothesis although the pituitary seems to influence interstitial growth of bone. In some cases it is familial and apparently hereditary. Syphilis and rickets are not thought to be factors. Blood chemistry studies attempting to establish calcium deficiency have not shown anything of value. It is said that amniotic bands or adhesions or severe trauma late in pregnancy are factors.

Its pathology, too, is not clearly understood. It is a fact, however, that diaphyseal cartilage is but a preliminary step in bone formation. Ossification of the shaft follows division of cartilage cells which are set free as osteoblasts by absorption of the cartilage envelope; rapid

*Read before the Brooklyn Gynecological Society, November 4, 1927.

proliferation of these cells results in ossification. In osteogenesis imperfecta bone formation remains in a primary fibrous state. Briefly, there is either a failure on the part of the osteoblasts to form periosteal bone, although cartilage calcification and bone absorption may be normal, or the normal ratio of absorption and bone formation is lost. Osteoporosis is secondary, and results from excessive formation of medullary spaces. The cartilage itself is not materially altered.

Baby D., male, born in the Greenpoint Hospital on October 9, 1927. Its parents were in good health with no evidence of acute or chronic disease or trauma, and there were six other children living and well.

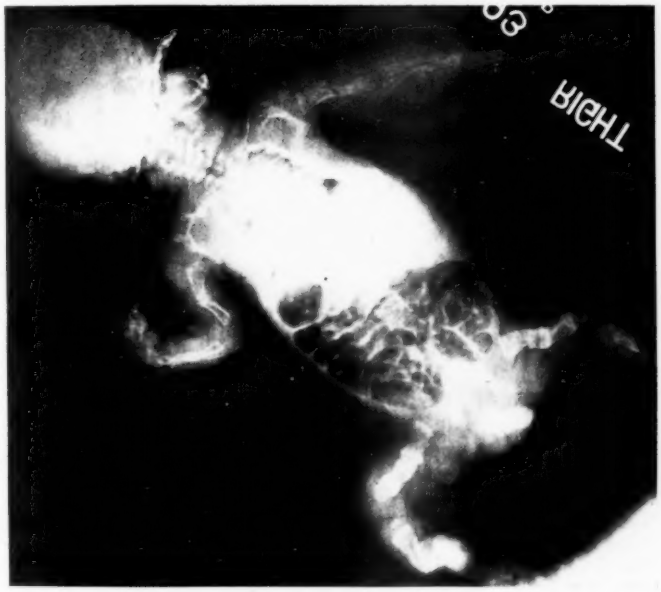

Fig. 2.—Roentgenogram of same fetus, showing fractures of both humeri, left clavicle, and left tibia. Both femurs show marked alterations in contour.

The mother was thirty-two years of age, with no history of miscarriages, and the course of all her pregnancies had been normal. At term she was delivered of a breech spontaneously without assistance.

The urine was normal, Wassermann negative, and blood pressure was 116/68. Blood count showed 5,500,000 R. B. C., with normal morphology.

The baby weighed 2400 gm., and cried at birth. Its color was poor, the head large with a great abundance of hair, with increased bitemporal diameter, and low implanation of the ears which were turned downward and outward. The cranial vault consisted only of scalp with scattered islands of bone, which crackled on touch. There were no sutures, no fontanelles and no evidence of molding. The torso seemed normal. Both upper and lower extremities were short, bowed and deformed, the lower extremities much shorter than the trunk, and bony crepitations were felt immediately after birth. The baby lived thirteen hours, and during this time no movement of the arms was observed.

Roentgenogram showed fractures of left clavicle, of both humeri, and the right radius, with marked shortening, bowing and alterations in contour of both femurs

and both tibiae and fibulae. The vault of the skull showed defective ossification and the thoracic cage was small with shortened ribs irregular in outline; spine and pelvis were normal. Only one large plate showing the entire fetus was taken.

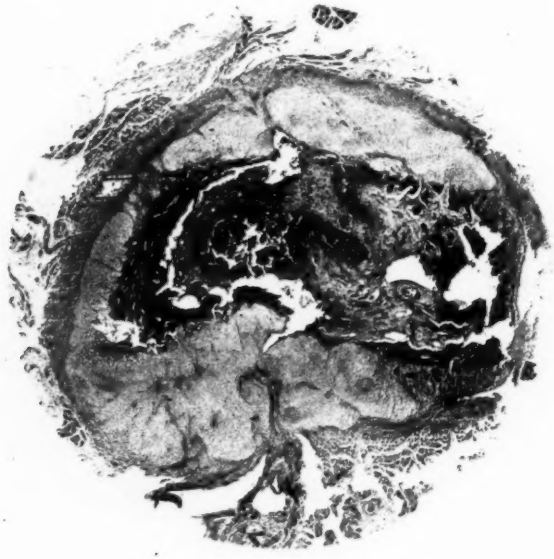

Fig. 3.—Transverse section of diaphysis of left humerus, decalcified, 8 microns thick. Stained in hematoxylin and eosin. Low power. The periosteum is much thicker than normal, and shows reaction to fracture at thickest points. Periosteal buds are seen. Normal layer of compact subperiosteal bone is missing. Marrow cells are abundant in the center. Bulk of section shows subperiosteal cartilage.

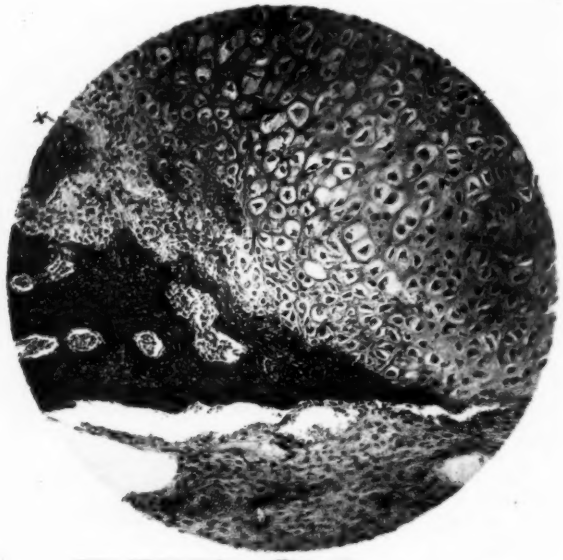

Fig. 4.—Area from Fig. 3, magnification 210 diameters. Fairly well ossified trabecula with area just above it showing blood vessel, increased cartilage matrix with deposit of calcium salts being surrounded by osteogenetic tissue, a calcification center in the cartilage.

A postmortem examination was made six hours after death by Dr. E. H. Nidish. The head was large, easily compressed, thickly covered with hair, bitemporal diameter increased, ears low, cranial vault composed of scalp with limited circular osseous deposits. Chest narrow, abdomen large, arms and legs short and curved, with callous masses and crepitations readily felt. Stump of umbilical cord dry and clear. Brain soft and pale.

The heart was small with thickening of mitral, aortic and tricuspid valves, foramen ovale patent, and ductus arteriosus closed. Thymus normal in size. Lungs normal except for some subpleural ecchymosis in lower lobe. The left clavicle was fractured and thirty-one fractures were found in the ribs.

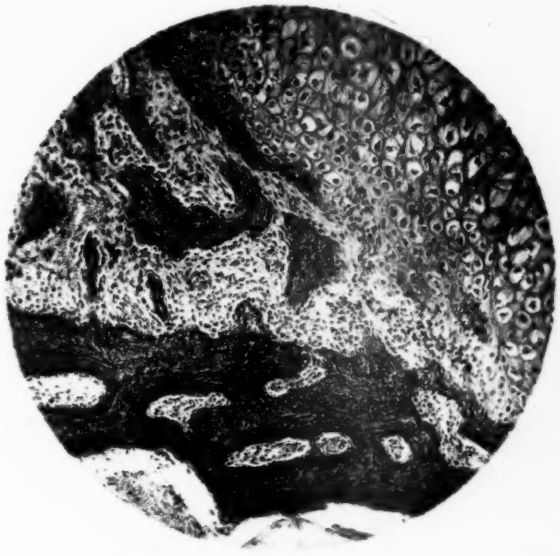

Fig. 5.—Area from Fig. 3, magnification 210 diameters. Many trabeculae of spongy bone, well covered with osteogenetic tissue pushing its way through the cartilage.

No gross or microscopic changes noted in gastrointestinal tract, liver, spleen, or kidneys.

The long bones were gray in appearance, easily bent and seemed soft and flexible. One humerus was broken during its removal. All the long bones were shortened, thickened and bowed with irregular surface, marks of callus rings.

A cross-section of diaphysis of humerus measured 8 mm. (normal 5 mm.) while the epiphyses were about normal. The marrow cavity measured 5½ mm. (normal 3 mm.). Periosteum thickened and periosteal buds seen here and there. Normal layer of circumferential compact subperiosteal bone absent. Bulk of section shows embryonal cartilage with vacuolization of cells. Trabeculae spongy with osteogenetic tissue very well developed in some areas, with large numbers of osteoblasts. Osteoclasts were scarce. Calcification centers were seen in the cartilage. Close contact of muscle with periosteum.

SUMMARY

1. Muscular action on cartilage probably accounts for the deformity of bone, and may increase the size of the marrow cavity.

2. Failure of subperiosteal bone formation, with marked decrease in the number of trabeculae, and persistence of embryonal cartilage constitute the essential lesion.

3. No evidence of disproportionate breaking down of bone was seen.

4. If any conclusion were to be drawn from this isolated study, it would seem that the condition is due either to defective function of the osteoblasts or possibly lack of sufficient preparatory calcification of cartilage.

(For discussion, see page 293.)

ECTOPIC CORPORA LUTEA*

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(From the Pathologic Laboratory of the Flower Hospital, New York, N. Y.)

THE corpus luteum in the past twenty-five years has been the subject of extensive morphologic, physiologic, and pathologic investigations. Most authors have studied the corpus luteum either as an independent unit or in relation to its influence on the uterus and on the ovum. Very little consideration has been given to its relation to the ovary of which it is normally a part.

The corpus luteum is intimately connected with the ovarian stroma. The stroma undergoes certain changes during the growth and rupture of the graafian follicle and also during the maturation and regression of the corpus luteum. The corpus albicans, after the organization is completed, becomes a part of the ovarian stroma.

Under pathologic conditions the connection of the corpus luteum with the ovarian structures may become less intimate, resulting in a partial or complete displacement of the corpus luteum as a whole from its intraovarian bed. The displacements of the corpus luteum have been studied chiefly by European investigators, but, from the review of English literature, I conclude they have received little or no attention in either England or America.

The pathologic changes and processes affecting the corpus luteum include the *hematoma*, the *cystic changes*, the *infections*, and the *neoplasms*. These conditions have been studied by the German school (especially by E. and L. Fraenkel, Halban, Orthmann, Pfannenstiehl, and others) and by Ewing and Novak in this country. Little attention has been given in several résumés of the pathology of the corpus luteum to the topographic changes which form the subject of this paper and the pathologic significance of which is only slightly known.

In human ovaries the corpus luteum is, as a rule, embedded in the substance of the ovary. In early stages of its development the corpus

*I wish to thank Dr. William E. Youland for his valuable help in preparation of this paper.

luteum may be seen as a vascular body situated immediately beneath the tunica albuginea and slightly bulging over the surface of the ovary. Usually the corpus luteum may be distinguished only by the point of follicular rupture which may be patent, with a small amount of "lutein" tissue protruding through it, or occluded and vascularized. In later stages the corpus luteum is often revealed only on sectioning the ovary.

Under pathologic conditions the corpus luteum may be partially or completely *extruded* from the ovary, occasionally assuming an extraovarian position. In reviewing the literature 24 cases of this anomaly could be found, chiefly in the German and Russian literature. As mentioned previously, no articles or case reports dealing with this anomaly could be found in the English or in the American literature.

In 1898 Stratz described in an ape a recent corpus luteum which was fully everted outside of the ovary, forming a mushroom-like structure with a pedicle consisting of the ovarian tissue.

In 1899 Schnell found a corpus luteum protruding through a defect in the tunica albuginea and connected with the ovary only in a small portion of its surface.

In 1901 Lefas described an "aberrant" corpus luteum attached to the fimbriae of the fallopian tube, and Gruzdeff reported a case of "complete prolapse" of the corpus luteum.

Twenty-one more cases of partial or complete separation of the corpus luteum from the ovary have been described by Lwoff, Luppoff, Schroeder, O. Frankl, Stolper, Matsuno, and Mandelstamm.

Some textbooks (Gebhard, Pfannenstiehl) mention the separation of the corpus luteum as a rare anomaly.

Although only 24 cases of this anomaly have been published in twenty-eight years, the surgical material of the Flower Hospital of New York has offered the opportunity of seeing 2 cases of pedunculated corpora lutea and a number of transitional forms in a short period of five months (the 2 cases of pedunculated corpora lutea occurred within two days). In addition several more examples of topographically atypical corpora lutea which are not included in this report have been met with in this laboratory. It would appear that this anomaly is not uncommon.

CASE REPORTS

CASE 1.—M. R., thirty years old, married; operation of uterine suspension with removal of inflamed adnexa. Menstruation every twenty-eight days. Last period Nov. 1. Operation Nov. 26. Vaginal bleeding, moderate, on Nov. 28. The following period Dec. 28.

Gross Description: The ovary (Fig. 1) consists of two parts. The larger part is pale and wrinkled and measures 4.5 by 2.5 by 1 cm. The smaller part is brownish-yellow in color, with smooth surface, and measures 1.3 by 1.5 by 1 cm. The larger portion of the ovary contains a number of small follicular cysts and presents a

deep notch on its outer pole. A linear slit leads from the notch into a collapsed cavity 1.2 cm. deep, with rough vascular walls. No blood clots present in the cavity. The tunica albuginea of the ovary bridges over from the brim of the slit to the smaller portion of the ovary, in the form of a thin, flat pedicle. The smaller portion of the ovary which is freely movable on its pedicle presents a corpus luteum in the stage of maturity, with a distinct stigma.

Microscopic: The section through the corpus luteum presents a menstrual corpus luteum in the stage of maturity. The section through the collapsed cavity (Fig. 2) shows a slit in the loose, somewhat edematous connective tissue surrounded by a number of hyalinized blood vessels, a few small follicular cysts, a few corpora albicantia and fibrosa. Several of the smaller blood vessels are torn, allowing a small amount of blood to escape into the loose connective tissue and on the surface of the cavity. No signs of repair around the slit.

Diagnosis: Pedunculated corpus luteum of menstruation, third period; escape occurred shortly before the operation or during the operation.

CASE 2.—S. F., thirty years old, married. Removal of the left ovary and resection of the right ovary. Menstruation regular.

Fig. 1.—Case I. Pedunculated corpus luteum. *O*, ovary; *C.L.*, corpus luteum. The arrow touches the brim of the cavity. The cavity, previously collapsed, was distended by means of a piece of glass rod.

Gross Description: The left ovary (Fig. 3) consists of two parts. The larger part is pale and wrinkled and measures 3 by 1.5 by 1.7 cm. The smaller part is reddish in color, irregularly ovoid in shape, and measures 2 cm. in length and 1.5 cm. in diameter. The two portions are connected by means of a thin, flat, wrinkled isthmus continuous with the tunica albuginea and arising from the brim of a shallow depression on the surface of the ovary.

Microscopic: The surface of the notch is covered with fibrin invaded with a large number of fibroblasts and new blood vessels. A large corpus albicans is situated below the area undergoing organization. The remainder of the ovary presents considerable fibros and contains a number of ripening follicles and a few small follicular cysts. The smaller portion of the ovary consists of a corpus luteum in the stage of maturity.

Diagnosis: Pedunculated corpus luteum of menstruation, third period.

In neither of these two cases has the displacement of the corpus luteum been noticed by the surgeons.

CASE 3.—F. S., thirty-two years old, married. Removal of a uterine polyp, of the lacerated cervix and of a cystic ovary.

Gross Description: The ovary (Fig. 4) measures 5 by 2.5 by 2 cm. The surface is pale and smooth. A few small translucent cysts are seen beneath the tunica albuginea. A large, soft corpus luteum protrudes through a slit in the tunica albuginea with about one-third of its surface. On section the corpus luteum is conoid in shape, with the apex in the slit.

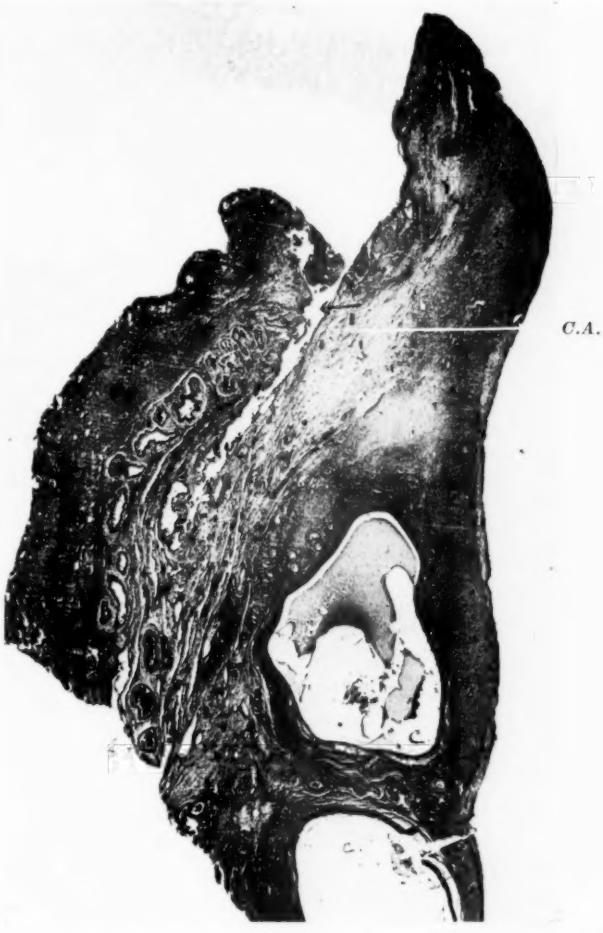

Fig. 2.—Case I. Section through the collapsed cavity (low power). *b.v.*, blood vessels; *C*, follicular cysts; *C.A.*, corpus albicans. The arrow points out the collapsed cavity left after the escape of the corpus luteum.

Microscopic: The stroma near the slit is edematous, the tunica albuginea recedes from the corpus luteum. The corpus luteum is in the stage of proliferation.

Diagnosis: Corpus luteum in the end of the first stage; beginning expulsion.

CASE 4.—I. B., thirty-nine years old, married. Ventrosuspension and removal of adnexa (cystic ovaries).

Gross Description: The ovary (Fig. 5) measures 4 by 3 by 1.5 cm. A round, brownish body 1.5 cm. in diameter is situated on the upper pole of the ovary,

being embedded in the ovarian stroma with about one-quarter of its surface. A deep groove separates the body from the main mass of the ovary. On section the body proves to be a corpus luteum in an early stage of development. The ovarian stroma is fibrosed and contains a few follicular cysts.

Microscopic: The stroma presents fibrosis and cyst formation. The corpus luteum, in the end of the first or in the beginning of the second stage of its development, is surrounded by a narrow strip of the ovarian stroma which is thinnest at its pole. The germinative epithelia dip into the groove mentioned above and ascend to about one-half of the corpus luteum.

Diagnosis: Polypoid corpus luteum.

CASE 5.—R. L., Forty-three years old, married. Metrorrhagia; oophorectomy.

Gross Description: The ovary measures 3 by 1.5 by 1.2 cm. Almost one-half of the ovary is occupied by a flattened corpus luteum, constricted by means of a groove from the rest of the ovary. The stigma of follicular rupture is situated on the side of the corpus luteum.

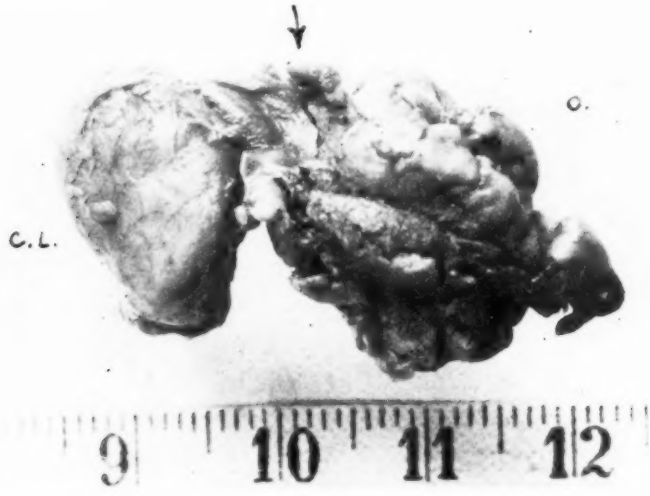

Fig. 3.—Case II. Pedunculated corpus luteum. *O*, ovary; *C.L.*, corpus luteum. The arrow points out the depression with an elevated brim, the former site of the corpus luteum.

Microscopic: The stroma contains numerous corpora albicantia, some of which are situated immediately beneath the germinative epithelia. The corpus luteum is in the first stage of its development. The germinative epithelia cover a small portion of the corpus.

Diagnosis: Polypoid corpus luteum.

CASE 6.—C. S., forty-five years old, married. Metrorrhagia; myomectomy.

Gross Description: Left ovary measures 5 by 4.5 by 2 cm. On the upper pole of the ovary a corpus luteum with a congested stigma is constricted from the main mass of the ovary, together with a small portion of the ovarian tissue. The stigma is situated on the side of the corpus luteum. A follicular cyst, filled with gelatinous material, is situated beneath the corpus luteum.

Microscopic: Corpus luteum of menstruation in the second stage of its development, surrounded by a small amount of ovarian stroma.

Diagnosis: Polypoid corpus luteum.

The corpora lutea of the first 2 cases belong to the pedunculated variety and are almost identical with the 2 cases of incomplete prolapse, described by Lwoff. Cases 4, 5, and 6 belong to the polypoid corpora lutea described by Luppoff and Schroeder. Case 1 presents a recent corpus luteum which escaped from the congested and edematous ovarian stroma surrounded at a distance by resistant structures (corpora albicantia, hyalinized blood vessels, follicular cysts). The escape must have taken place shortly before the removal of the ovary, as there is no indication of beginning organization of the collapsed

Fig. 4.—Case III. A corpus luteum partially expelled through the "stigma." *C.L.*, corpus luteum; *S*, salpinx.

cavity. In the second case the corpus luteum must have escaped from the ovarian stroma much earlier than in the first cases, judging from small dimensions and shallowness of the former site of the corpus luteum and from advanced organization on the surface of the depression. Both ovaries present considerable fibrosis and cyst formation. The third case presents a corpus luteum in an early stage of expulsion, impacted in the weak spot of the tunica albuginea corresponding to the place of follicular rupture. In Cases 4, 5, and 6 the corpora lutea

are situated more superficially than in Case 3. In Case 4 the ovarian stroma receded from three-quarters of the surface of the corpus luteum; in Case 5 more than one-half of the corpus protrudes over the surface of the ovary; in Case 6 the entire corpus luteum with a small portion of the ovarian stroma is being constricted from the main mass of the ovary. In Cases 4 and 6 follicular cysts are situated in the closest proximity of the base of the corpus luteum, the remainder of

Fig. 5.—Case IV. Polypoid corpus luteum. The ovary has been sectioned and opened "like a book." *C.L.*, corpus luteum; *S*, salpinx.

the stroma presenting a considerable degree of fibrosis. In Case 5 the fibrosis is very extensive.

In analyzing different forms of partial and complete separation of the corpora lutea, published previously and described above, one feature common to all of them can be noticed, namely, the *displacement* of the corpora lutea from their intraovarian site toward the periphery. Until the present time there has been much confusion about the terminology of this anomaly. With 24 cases previously published at least four different names have been used, some of them being used in a

different sense. The term "ectropium" (Gebhard), which can be applied only to everted corpora lutea is used by Strakosch to designate the small hernia-like protrusion of the "lutein" tissue frequently seen around the stigma. The "aberrant corpus luteum" does not include the incomplete separation. "Prolapse," the name used by most German and Russian authors, seems to be the most popular, but Frankl uses it only for everted corpora lutea, applying the term "expulsion" to all other forms of separation of the corpus luteum. Most of these terms attempt to combine the anatomic conception with the explanation of the pathologic mechanism. As the mechanism is not always the same, none of the above mentioned terms can be satisfactorily applied to all known cases.

The term "ectopic corpora lutea" is here proposed since the condition primarily is a *displacement* of the corpus luteum from its intraovarian bed to a degree not present in the topographic relations of the normal corpus. This term is definitive and permits the subdivision allowing the inclusion of various cases reported.

Three forms of ectopic corpora lutea may be distinguished:

1. Polypoid corpora lutea,
2. Pedunculated corpora lutea,
   a. everted,
   b. noneverted,
3. Free corpora lutea.

The *polypoid* corpora lutea are elevated above the surface of the ovary being connected with it by less than one-half of their surface. A deep groove corresponding to the place of retraction of the ovarian stroma constricts the corpus luteum from the ovary. The tunica albuginea covers the corpus luteum as a thin avascular membrane which is thinnest at its pole. The stigma is located on the lateral aspect of the corpus luteum. The germinative (Waldeyer's) epithelia covering the surface of the ovary dip into the groove and ascend to a certain height on the bulging corpus luteum, gradually becoming flat, and disappearing on the pole of the corpus luteum. The polypoid corpora lutea become superficial corpora albicantia. There is no indication as to the possibility of further separation of polypoid corpora lutea, except, perhaps, in cases of gradual expulsion by progressively growing massive cysts. The polypoid corpus lutea are seen quite frequently. Four corpora lutea of this variety have been described by Schnell, Luppoff, and Schroeder; three have been described here.

The *pedunculated* corpora lutea may be everted and noneverted. In the everted form the pedicle consists of the ovarian stroma which may contain follicles. The theca externa forms the innermost layer of such corpus, the inner connective-tissue layer forms the outer covering. Two cases of this variety are known (Stratz, Frankl).

In the noneverted form the pedicle consists of a flat, thin piece of the tunica albuginea arising from the border of a depression on the surface of the ovary. The depression is deep in recent cases and shallow in older cases. The corpus luteum is invested in all its coats and is surrounded by a narrow zone of connective tissue which may be followed through to the tunica albuginea of the pedicle. Two cases of this type have been described by Lwoff and two were seen in our laboratory. The noneverted pedunculated corpora lutea probably become completely separated from the ovary.

The *free* corpora lutea ("corpora libera" of Luppoff) may arise either by gradual liberation of pedunculated forms or by complete expulsion of the corpora lutea not having any firm connections with the ovarian stroma at the time of separation. The free corpora lutea have been found altogether free in the sac of Douglas, or implanted on the peritoneum of the sac of Douglas, of the uterus, salpinx, etc., by means of a newly formed fibrous pedicle. They were found also loosely connected by means of fibrin to the intact surface of the ovary. The free corpora lutea vary in their dimensions from the size of a normal corpus to small shrunken bodies described by Lwoff as "size of a cherry pit." They are usually covered with both thecae. Occasionally the theca externa or both thecae are absent, so that the granulosa forms the outer layer of the free corpus. In old organized corpora lutea the microscopic examination is necessary to identify the corpus by an old central blood clot surrounded by a festooned layer of connective tissue with a straight layer of connective tissue on the periphery. Implanted corpora lutea show the greatest degree of organization in the portion nearest to the newly formed pedicle. The final fate of a free corpus luteum is most probably resorption, which may require a very long time (as in a case of Luppoff's). Sixteen cases of free corpora lutea have been reported in the literature (Lefas, Gruzdeff, Lwoff, Luppoff, Frankl, Stolper, Matsuno, Mandelstamm).

The few extraovarian corpora lutea examined as to their nature and stage of development proved to be menstrual corpora lutea in the second or third period of their cycle. Both pedunculated corpora lutea presented here were menstrual corpora lutea in the stage of maturity.

Two causes, usually referred to as giving rise to ectopic corpora lutea, are: *sudden traumatic extrusion* by the surgeon during an operation or bimanual vaginal examination of the adnexa and *gradual expulsion* by progressively growing massive ovarian cysts. The superficial situation of the graafian follicle, delayed cicatrization of the stigma, large size of the corpus luteum, and increased vascularization of the ovarian stroma are mentioned as contributing factors.

Mechanically in all these conditions there is increased intra-ovarian pressure (for a short time, as in traumatic extrusion, or for a longer

time, as in progressively growing cysts) expelling the corpus luteum in direction of least resistance, toward the stigma which for a long time remains a weak spot on the surface of the ovary. Multiple follicular cysts and fibrosis of the ovary contribute to the superficial situation of the follicles and corpora lutea.

No pathologic importance has ever been attributed to polypoid corpora lutea, as they are still intimately connected with the ovary and undergo organization in the usual manner, merging finally with the ovarian stroma. The pathologic significance of the extraovarian forms is a matter of dispute.

The pedunculated corpora lutea were considered as a portal of entrance for ovarian infection (Schnell). The escape of a corpus luteum was considered as one of the causes of intraperitoneal hemorrhages (Schnell, Sarrouy and Dubouchcr). Free corpora lutea were regarded as a possible source for development of extraovarian "lutein" cysts. The possibility of infection through everted corpora lutea and through the ovarian defect, left after the escape of a corpus, is obvious. An intraperitoneal hemorrhage could be expected after the separation of the corpus luteum from the ovarian stroma, but in the cases where the escape occurred under the surgeons' observation the loss of blood was very small. Large hemorrhages from the corpus luteum are usually connected with its rupture or with an ovarian pregnancy. The possibility of extraovarian (or, perhaps, also "ectopic") cysts of ovarian origin may be considered in cases similar to those reported by Lwoff and Stropeni, although separation of previously formed cysts from the ovary is more probable.

In the present time the school of Halban is inclined to attribute to implanted and nonimplanted corpora lutea an endocrine rôle similar to that of "persistent corpora lutea" of the cattle, with an inhibiting influence on menstruation and ovulation. Stolper thinks that the removal of a free corpus luteum brought about the onset of menstruation in his patient. Matsuno attributes an amenorrhea of four months' duration in his patient to the inhibiting function of an implanted corpus luteum. Their opinion is opposed by Mandelstamm who, in reviewing the literature, does not find any cases where the amenorrhea, if present, could not be explained in some other way besides an inhibiting influence of ectopic corpora lutea. In the first case reported here the onset of menstruation after the removal of a pedunculated corpus luteum cannot be attributed to the removal, because the menstruation occurred on the expected date. The ovulation has not been disturbed in Stolper's patient who had two successive pregnancies, an intrauterine (resulting in an abortion) and a tubal, which occurred without a menstrual period between the pregnancies, in spite of a free corpus luteum present in the peritoneal cavity; from Stolper's gross description the corpus resembles a menstrual corpus luteum.

It is evident that the number of cases thoroughly studied both from the clinical and pathologic points of view is insufficient to draw any definite conclusions about the endocrine function of ectopic corpora lutea. It would be advisable to make a careful investigation of the preoperative and postoperative menstrual histories in all cases of ectopic corpora lutea. The nature of such corpora lutea should be recorded after gross and microscopic examination. The cases of amenorrhea, if any abdominal operation is performed, should be investigated for presence of ectopic corpora lutea. The relation between the removal of the corpora lutea and the menstruation may be established by surgeons, who frequently resect intraovarian corpora.

CONCLUSIONS

Considering two cases of pedunculated corpora lutea and a few transitional forms in our surgical material within five months, and three ectopic corpora in one year in Lwoff's and in Luppoff's surgical practice, it seems that ectopic corpora lutea are not a very rare anomaly. No definite pathologic significance can be attributed to the ectopic corpora lutea at present. It is possible that the ectopic corpora lutea will be seen more often and more will be learned about their significance if the surgeons will be more familiar with the existence of this anomaly. The complete absence of information in the English literature on the subject discussed here, even if it proves to be of minor pathologic importance, seems to justify a review of cases already reported and presentation of additional cases.

SUMMARY

1. Corpora lutea may become partially or totally separated from the ovary.

2. Twenty-four cases of this anomaly have been published previously in the European literature; six additional cases are presented, illustrating different degrees of "displacement."

3. The term "ectopic corpora lutea" is proposed for this anomaly.

4. The inhibiting influence of ectopic corpora lutea on menstruation and ovulation has not been definitely established and requires further clinical and pathologic observation.

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LAPAROTRACHELOTOMY: AN ANALYTIC REPORT OF FORTY CONSECUTIVE OPERATIONS WITHOUT A DEATH*

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LOW cervical cesarean section had gained considerable favor in European clinics in the decade just prior to the World War. In our country this type of operation was practically untried until after that epoch and is just beginning to be accepted, due to the favorable reports of Hirst, Polak and Beck, DeLee and a few others.

The series herein reported represents an analysis of forty consecutive low cervical operations over a period of five years performed by one of us (Stein). Twenty of these operations were performed on patients in the private practice of one obstetrician (S), an incidence of one in 22.6. This rather high incidence of section is justified, we believe, by the critical analysis of our indications, and by our results. There were no maternal deaths in this series, and all but one baby left the hospital alive. We believe that the low morbidity revealed in our analysis could have not been attained had other methods of delivery been employed, such as high forceps, version, pubiotomy and craniotomy. Furthermore, we feel certain that the same result would not have been possible with the classic cesarean section. Küstner, in a very superior monograph on cesarean section[6] discussed the indications and advantages of each of the four types of operation and showed that the results of the leading German obstetricians utilizing the transperitoneal cervical section were most favorable. Although slow to adopt a new method, gradually one American obstetric surgeon after another is abandoning the classic cesarean for laparotrachelotomy.

We were not at all favorably impressed by the first few operations of this type which we witnessed, but soon after employing the method

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we were completely converted to it, and in consequence have not performed a single classic section since the beginning of this series. Since August, 1922, we have performed forty consecutive low cervical sections up to July, 1927. This represents twenty private cases, eight service (ward) cases and twelve patients referred or in consultation. A fetal roentgenogram was taken routinely before operation, with but few exceptions, to insure the presence of a normally formed baby.

Advantages.—The advantages of laparotrachelotomy over the classic and extraperitoneal sections have been concisely stated by DeLee[1] who has studied a large series of operations in the Chicago Lying-In Hospital, representing the work of twenty operators under his direction. This group consists entirely of practicing obstetricians and obstetric specialists, and *not general surgeons.* We believe that this fact, coupled with the close supervision by Dr. DeLee, accounts for the splendid results obtained in their series. We feel that this method is superior to other types of cesarean section considering the various indications and the time of performance. The method recently described by Brodhead, Langrock and Cassasa[2] while proving safe from peritonitis was nevertheless attended by a 3 per cent maternal mortality from hemorrhage.

One cannot erase from memory Newell's startling report in 1917 of the horrible results obtained by general surgeons and practitioners in cesarean section.[3] What occurred in the vicinity of Boston in cities of 25,000 to 40,000 inhabitants undoubtedly occurred, and still does occur today in many other cities all over this country. Newell reported that in *Hospital A, investigation proved that all the mothers died after cesarean section; in Hospital B, the mortality was 60 to 75 per cent; that in Hospital C, section was always fatal when performed by the local surgeon; and in Hospital D, the average mortality was 10 to 20 per cent, and in eclampsia it was 50 per cent.''** Welz recently published the mortality from cesarean operations in the city of Detroit for 1926.[4] There were 154 sections with a 13 per cent maternal and 11 per cent fetal mortality. Compare these astounding facts with the results obtained by obstetric surgeons such as Hirst, Polak, DeLee, Williams, Peterson and others and there is no further need for argument as to who is best qualified to perform cesarean section.

In 1914 Opitz published a remarkable series of 443 low cervical sections for contracted pelvis with no deaths.[5] This was not a consecutive series, however, as deaths occurred in sections for eclampsia, heart disease, carcinoma, and other complications of pregnancy. This was at a period when Küstner reported 103 extraperitoneal operations with 2 per cent mortality, and Latzko, Bumm and Weibel published mortalities of 4.21 per cent, 2.85 per cent, and 3 per cent, respectively, with the transperitoneal operation.[6]

*Italics ours.

Indications.—Dystocia due to disproportion at the inlet is the outstanding indication for section in our series. Dystocia becomes manifest when engagement of the presenting part fails after an adequate test of labor. In thirty-two of our cases, of which 75 per cent were primiparae, dystocia at the inlet was diagnosed after an average test of labor of 29.8 hours. (Table I.) This complication occurred in some patients with normal pelvis and normal sized child where the presentation, position, or attitude was responsible for the maladaptation, as well as in patients with contracted pelvis, oversize child, or uterine malformation. In view of these findings it becomes obvious that accurate pelvimetry and cephalometry cannot always designate the clinical course of labor; deflexion and posterior position of the head frequently alter the expected course. What constitutes an adequate test of labor is a matter of dispute and must be decided after a careful study of each individual case. That no arbitrary number of hours can be considered a sufficient test for any given group of cases is well illustrated by the protracted discussion of this question by the members of the American Gynecological Society in consideration of Bailey's splendid paper[7] on this subject.

TABLE I. TEST OF LABOR 32 CASES

	HOURS
Shortest test	12
Longest	66
Average	29.8

Our remaining indications listed in Table II require no especial discussion. We may add, however, that the preliminary use of the hydrostatic bag serves as no contraindication to this type of cesarean section. The Voorhees bag was inserted in three of our patients from eight to thirty-three hours before section, in all of whom the mem-

TABLE II. INDICATIONS

	NO. CASES		PER CENT
Test of Labor	32		80.
Normal Pelvis		7	
Contracted Pelvis		13	
Mammoth Child		6	
Malformed Uterus		1	
Abnormal Presentation		3	
Postmaturity		2	
Habitual Fetal Death	3		7.5
Old Primiparity	4		10.0
Organic Heart Disease	2		5.0
Previous Cesarean	1		25.0
Eclampsia	1		5.0
Pre-Eclampsia	1		
Abruptio Placentae	1		2.5

In some of the cases more than one of the above indications were present.

Table III. State of Membranes

	CASES	PER CENT	HOURS
Intact	29	72.5	
Ruptured	11	27.5	
Shortest time			4
Longest time			72
Average time ruptured before operation			17.7

branes had previously ruptured, resulting in no serious increase in morbidity in the puerperium. (Table V.) Even in patients where the membranes were long ruptured and in whom intrapartem temperature rise was noted, the stay in the hospital was not prolonged. Five of such cases appear in our series, and in two of these the amniotic fluid

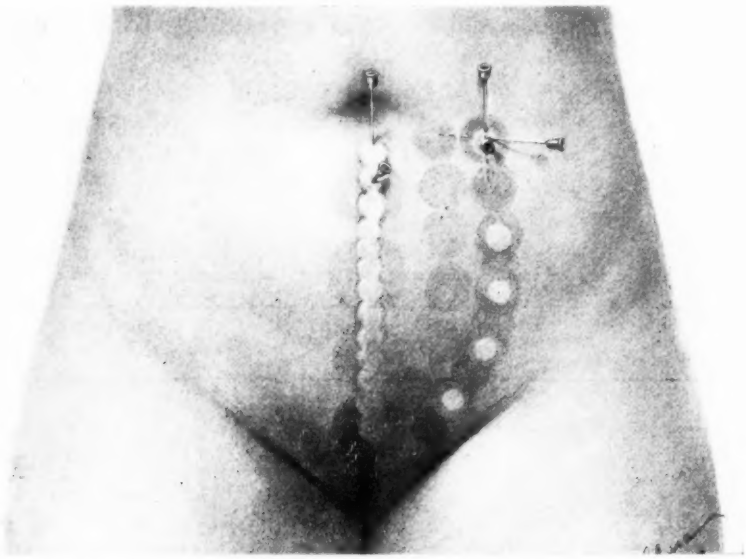

Fig. 1.—Infiltration of abdominal wall with local anesthesia. Median line is first infiltrated and then right and left lateral nerve blocks are simultaneously made. The entire procedure requires but five minutes.

was purulent, B. coli being obtained in cultures. The cord blood in these two cases also yielded B. coli, and the placentas upon microscopic examination showed evidence of marked placentitis.

Technic.—The technic employed was essentially that described by DeLee except that in the last thirteen cases the transverse uterine incision was used, as was recently described by Munro Kerr[11] and first suggested by Kehrer in 1881.

Preoperatively the external genitalia and abdomen are shaved and thoroughly cleansed with green soap and water. The entire perineum is then coated with 1 per cent mercurochrome solution, and catheterization is done with a No. 16 soft rubber male catheter. Two drachms of the 1 per cent mercurochrome solution is instilled into the bladder before the catheter is removed. One ounce of the mercurochrome

solution is then instilled into the vagina by means of a glass irrigating syringe, and the perineum is covered with sterile towels. The abdomen is further prepared with 60 per cent alcohol, ether, and a coating of half strength tincture of iodin. The patient is placed in a moderate Trendelenberg position, and the abdominal wall is infiltrated with ½ per cent novocaine solution with two minims 1:1,000 adrenalin solution to the ounce. As much as 5 to 6 ounces of this solution may be safely used. Beginning just below the umbilicus, the midline is first infiltrated intracutaneously by a continuous series of blebs, and then through these the fused sheaths of the recti muscles are infiltrated. In lines closely paralleling the external borders of both underlying recti muscles, two more series of intracutaneous blebs are made, five on each side, and deep injections through these as far as the approximate depth of the transversalis muscles, for it is at this level that the nerves branch off which supply the abdominal wall. The plane of this infiltration reaches from just above the level of the umbilicus to the crest of the pube, and blocks the tenth,

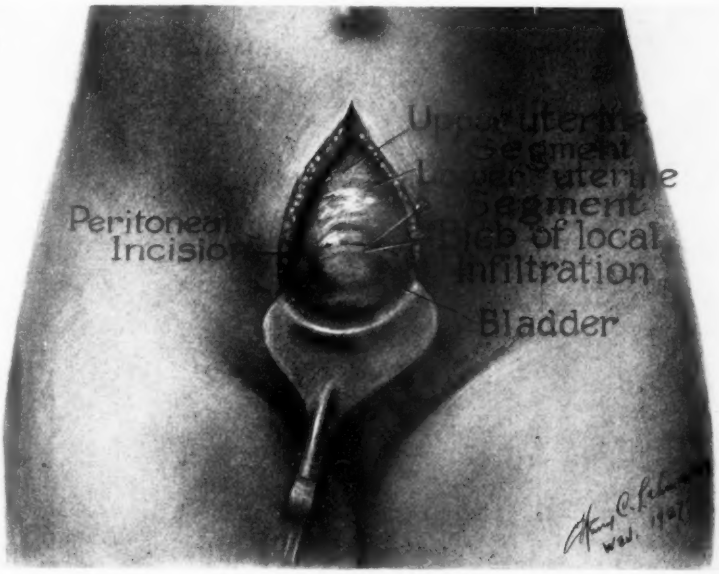

Fig. 2.—Lower uterine segment exposed with the use of a single retractor. Local infiltration of visceral peritoneum is indicated, as is also the site of the peritoneal incision. The abdominal incision is just large enough to permit the delivery of the fetus. No laparotomy pads are inserted.

eleventh, and twelfth intercostals, the ilio-hypogastric, and the ilio-inguinal nerves. Experience has taught us that the region just above the symphysis pubis is always most sensitive and requires more anesthesia. This is readily accounted for by the rich cutaneous nerve supply, this small region being supplied by cutaneous branches of the twelfth intercostal (subcostal), ilio-hypogastric and ilio-inguinal nerves. The infiltration requires about five minutes for completion, and at the end of this period it is possible to incise the skin and subcutaneous tissue painlessly. While the superficial bleeders are being ligated and laparotomy sponges are applied to the skin, the nerve block has more time to become effective. The abdomen is opened by a median incision from the upper border of the symphysis pubis upwards for 10 to 12 cm. (4 to 5 inches), the subcutaneous fat being dissected back from the fascia so as to make the latter more accessible for closure. The fascia and peritoneum are then incised, and the sides and inferior corner of the parietal peritoneum are anchored to the

subcutaneous fat by three temporary catgut sutures. If upon incising the fascia or peritoneum any area is painful, additional local infiltration is made. The bladder is then held under the symphysis, using one of DeLee's "corner retractors," thus exposing the lower uterine segment. About 5 to 8 c.c. of the local anesthetic is then injected under the visceral peritoneum covering the lower uterine segment (Fig. 2) and is diffused with the finger. The peritoneum now stands out from the uterine muscle, and is incised transversely midway between the bladder reflection and the retraction ring, and is loosened by blunt dissection upwards and downwards. The corner retractor is then slipped under the lower peritoneal flap, holding up the bladder and exposing the denuded lower uterine segment. A longitudinal incision about 3 to 4 inches in length is made with a scalpel through the

Fig. 3.—Transverse incision in lower uterine segment. A single forceps blade is placed anterior to the fetal head which acts as an inclined plane for delivery of the head when pressure is made over the uterine fundus.

musculature and as soon as the uterine cavity is opened, continuous suction of the liquor and blood is maintained by means of an aspirating apparatus. The fetal head is then delivered with forceps. The "hammock" forceps of DeLee is most useful in this operation. It is applied after the face is brought anterior by inserting a finger in the baby's mouth, and facilitates the delivery by direct upward traction. Immediately after delivery of the head, the edges of the uterine incision are grasped with several ring forceps and are lifted up, so as to prevent amniotic spill and also to expose the edges for closure. The placenta is usually allowed to separate spontaneously, but it is manually removed when the separation is delayed, and it is always delivered through the incision and is inspected before the closure of the uterine wound. After delivery of the child, the patient is given a hypodermic

of morphine sulphate gr. 1/6 and scopolamine gr. 1/150. In neurotic or apprehensive patients this medication may be given during the preoperative preparation of the patient. One ampoule of pituitrin is given intramuscularly just as the child is delivered, but ergot is only administered if bleeding is excessive. The uterine muscle is closed by two rows of No. 2 plain catgut continuous suture; the first suture closing the inner muscle layer being careful to coapt the ends of the incision accurately and also to avoid the decidua; the second row takes the remaining muscle and includes the fascial layer which overlies the lower uterine segment. Sometimes a third row of interrupted sutures is required. Rarely was the intestine or omentum visible in this series during the operation even though *no laparotomy pads were placed inside the peritoneal cavity.* The visceral peritoneum is closed by a seroserous suture of No. 00 plain catgut making an almost invisible line of

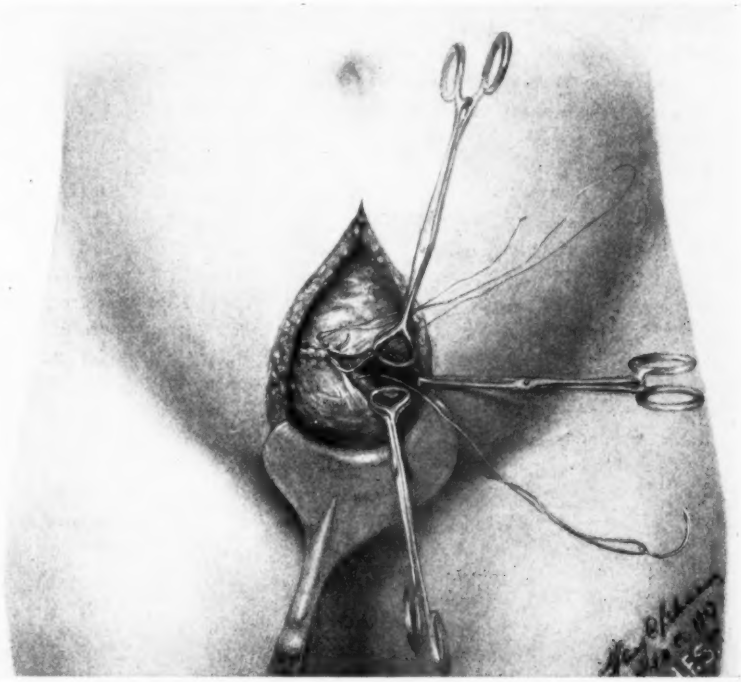

Fig. 4.—Suture of the transverse uterine incision. Note the satisfactory exposure of the entire wound with the use of only one corner retractor. The visceral peritoneum is united by a seroserous fine continuous suture leaving an almost invisible closure.

closure. The parietal peritoneum is loosened from the temporary attachments and united by a seroserous suture of plain catgut No. 1. The fascia is united with No. 2 plain catgut, a continuous stitch being employed interlocked every third, and for the skin a continuous black waxed-silk suture is used. A twisted silkworm drain is placed subcutaneously in the lower angle of the incision.

The same technic is used with the transverse uterine incision (as shown in these illustrations) except that the incision in the lower uterine segment is transversely crescentic with the concavity upwards. This is begun centrally with a scalpel and completed to either side with the Mayo scissors, thus preserving the integrity of the amniotic sac and controlling the spill. This incision is planned to lie entirely in

the lower uterine segment, and should be adequate for delivery of the fetal head, so as to avoid cutting or tearing into the circular sinus at the junction of upper and lower uterine segments. This precaution has resulted in an almost bloodless field, whereas if the circular sinus is severed, profuse hemorrhage occurs. In none of our cases was hemorrhage a real menace. The head may be delivered through this incision with the aid of the hand, or more commonly with one blade of a Naegele forceps placed anteriorly just over the symphysis and used as a vectis (Fig. 3). With slight fundal pressure, the fetal head rolls along the forceps as an inclined plane, and is born. This incision was used in our last 13 cases, and has advantage over the longitudinal incision in that there is less bleeding, the head is delivered more readily, and the incision is more accessible for suture (Fig. 4). We have never observed extension of this incision by tearing into the broad ligament or upward into the vascular upper segment. Large fetal heads were readily delivered through relatively small transverse incisions. We modified the technic further by individualizing the use of uterine packing rather than making it a routine. In unquestionably clean cases with intact membranes and where hemorrhage was not a factor, no intrauterine gauze packing was used (16 cases). In the potentially infected cases (eight), three of which ran intrapartum temperatures, we employed sponges soaked in ½ strength Dakin's solution placed in and about the uterine and abdominal incisions as described by Bell,[10] and in addition, in two of these we soaked the retained gauze pack with the same solution. In cases where the uterine pack was used the metal shuttle described by DeLee proved very useful both in introducing the end of the gauze through the cervix without contaminating the uterine cavity, and also in locating the gauze in the vagina for removal. The packing was in some cases removed at the end of the operation, in some at the end of six hours, or in twelve to twenty-four hours where the cervix was but little dilated. The operation usually requires about one hour from the beginning of the induction of the anesthesia whether local or general, until the final dressing is applied. The shortest time in this series was forty-five minutes (local) and the longest 105 minutes (local and ethylene-oxygen) the average being 64 minutes for the 40 cases. The dressings are not disturbed until the fifth day, when the silkworm drain is removed and the wound is inspected. Tension and silk sutures are removed on the eighth day after which the wound is supported by a special adhesive laparotomy corset, and the patient is allowed out of bed.

Anesthesia.—In 70 per cent of our patients local anesthesia was employed. (Table IV.) In seven of these, it was necessary to administer ethylene-oxygen analgesia in addition to the local, chiefly to satisfy the patient's request for gas. In these cases 25 per cent ethylene with oxygen was administered while the uterine and abdominal wounds were being sutured. Many of the patients admitted afterward that they really suffered no pain but that the idea of local anesthesia made

TABLE IV. ANESTHESIA

TYPE	NUMBER CASES	PER CENT
Ether	6	15.0
Ether, N_2O–O	3	7.5
Ether, Ethylene, O_2	1	7.5
Ethylene, O_2	2	5.0
Local (Alone)	21	52.5
Local, Ethylene, O_2	7	17.5
Total Local	28	70.0
Total	40	

them nervous and uncomfortable. In the early part of the series general anesthesia was used until we felt that our technic was smooth. We now feel very strongly that local anesthesia is preferable. We fully agree with DeLee that it requires greater gentleness in technic, thus favoring primary wound healing. We do not agree with the latter authority, however, in his criticism of the use of ethylene. He claims that ethylene changes the constitution of the blood so as to produce free hemorrhage. This statement, we believe, fails of proof. In fact that Straus and Rubin have shown[8] in their observations upon 25 patients that the *coagulation and bleeding times were decreased* both during and immediately after complete surgical ethylene-oxygen anesthesia. It does, according to Stander,[9] increase the *toxicity* of the blood, and therefore stands in the same class with other general anesthetics in relation to the toxemias of pregnancy.

Local anesthesia is just as applicable where time is a factor as is general anesthesia. In fact we observed that the operations which required the shortest time for performance were those done under local anesthesia upon patients who were calm and cooperative. We found that there was less straining and, consequently, less delay when the patient was awake and was willing to help. We rarely needed to use a sponge inside the peritoneal cavity or in the uterus in the patients under local anesthesia, the suction apparatus satisfactorily removing blood and liquor, but when retching or vomiting occurred during the induction of a general anesthetic, laparotomy pads were often required, as well as considerable sponging. The minimum trauma to the tissues obviously makes for greater comfort to the patient during convalescence and conduces to more perfect wound healing.

Convalescence.—Convalescence from low cervical cesarean is most satisfactory. Freedom from the usual surgical postoperative discomforts is strikingly noticeable to all who share in the aftercare of these patients. Shock, sepsis, hemorrhage, and peritonitis, the cardinal dangers of classical section, are conspicuous by their absence from the morbidity list. Patients are usually well enough to eat a light meal a few hours after section under local anesthesia, and rarely have any complaints throughout the convalescence.

The complications encountered in our patients were more or less of a minor nature (Table V). The sapremia, pyelitis, and ileus here

TABLE V. MORBIDITY, COMPARING LOCAL AND GENERAL ANESTHETIC

COMPLICATION	TOTAL, 40 CASES	LOCAL, 21 CASES	GENERAL, 19 CASES
1. Nausea	17 or 42.5%	3 or 14.3%	14 or 73.6%
2. Ileus	4 or 10 %	2 or 9.5%	2 or 10.5%
3. Abdominal Wound Infection	2 or 5 %	2 or 9.4%	0 or 0 %
4. Pulmonary Complications	2 or 5 %	1 or 4.5%	1 or 5.2%
5. Pyelitis (Mild)	3 or 7.5%	0 or 0 %	3 or 26 %
6. Sapremia (Mild in all cases)	7 or 17.5%	6 or 28.5%	1 or 5.6%
7. Breast Infection	2 or 5 %	2 or 9.4%	0 or 0 %

listed were not severe. There were no bladder injuries, and only the usual number of catheterizations required after pelvic delivery were needed.

It was observed in a number of uncomplicated afebrile patients that in the early puerperium the lochia were notably scant. This fact disturbed us somewhat at first, but later gave us no concern as involution proceeded normally in these cases.

Patients are usually permitted the back rest on the third day and allowed to sit in a chair on the ninth day, the skin sutures having been removed on the day previous. The patient is discharged from the hospital as a rule on the twelfth to fourteeth day. (Table VI.)

TABLE VI. CONVALESCENCE, 40 CASES

	AVERAGE DAY OUT OF BED	AVERAGE DAY DISCHARGED FROM HOSPITAL
19 Cases General Anesthetic	13.8	16.3
21 Cases Local Anesthetic	11.5	13.2
Total Average	12.2	14.9

CONCLUSIONS

1. Low cervical cesarean section so popular in European clinics is gaining favor in America because of the striking results as compared with those of classic section.

2. This type of operation because of its safety permits of far broader indications than does the classic cesarean, and should be chosen in preference to high forceps, pubitomy, or craniotomy when dystocia from disproportion at the inlet is manifest.

3. Rupture of the membranes, previous bag induction, and antepartum or intrapartum infection do not contraindicate this type of abdominal delivery.

4. An adequate test of labor is more significant in establishing the indication for laparotrachelotomy than are accurate pelvic measurements.

5. The operation under local anesthesia as described above is highly recommended because of the low morbidity, rapid and smooth convalescence, and applicability to the widest range of indications for cesarean section.

6. The operation while not difficult is purely an obstetric procedure and should be performed by the surgically trained obstetrician.

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(For discussion, see page 295.)

FIVE YEARS' EXPERIENCE WITH LOW CERVICAL CESAREAN SECTION*

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In 1922 we began in the gynecologic-obstetric service of the Evanston Hospital to make use of the low cervical cesarean section. We were moved to try the operation because of the favorable reports by DeLee and Beck in this country and by the results from many German clinics appearing in the literature, as well as those from French and English sources. Our experience with cesarean section prior to that time had caused us to conclude that, while the classic operation was very satisfactory in the elective case or for the woman who was still in the early hours of labor, convalescence in cases operated upon after labor had been in progress any length of time was so stormy that one hesitated to use the operation after a test of labor. Reports from many sources agree that the danger of classic section increases with the length of labor. This interferes with its usefulness as a procedure which may be used after a test of labor. The unjustifiably high death rate from cesarean section in this country is due, at least in part, to the use of the operation after many hours of labor. Sections done after attempts at vaginal delivery have been made, with consequent infection of the genital tract, have caused many deaths, with a consequent increase in the percentage of mortality. This was very clearly shown by the report of Eardley Holland who carefully studied the results of about 4000 sections in the British Isles. It is generally agreed that classic section is essentially an elective operation, or one for the early hours of labor, and that its use after many hours of labor is open to question.

If one accepts this conclusion, and it has been our position for many years, then one must either operate before labor, or, should engagement fail to occur after an adequate test of labor, one must terminate the labor from below by whatever means may be possible. This means an inevitable increase in infant mortality. It means also that the mothers are subjected to forms of interference which carry a

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mortality at least equal to that which our experience has shown us may be expected from the low cervical operation, as well as to injuries which are sometimes extensive, and the repair of which, owing to the poor condition of the mother, is often unsatisfactory. If one adopts one alternative, unnecessary sections are done in the fear of dystocia. If the other is chosen, a certain percentage of difficult deliveries is inevitable with the consequent fetal loss of life and maternal injury.

In the border-line class of pelvic contraction, experience shows that 80 per cent of women will deliver either spontaneously or with a simple and easy forceps to help them after tedious labors. It is particularly in this class of cases, in which one wishes to try a test of labor, that a safe method of abdominal delivery for the minority in whom the test of labor fails, is of value. Our first operations were done under these circumstances.

Our first cases impressed us by their easy, smooth convalescences. These women who had been operated upon after many hours of labor had far less distention and vomiting than we had been accustomed to see in our elective classic sections. While at first elective operations continued to be done by the classic method, this difference in the character of the recovery from the two operations caused us to use the older operation less and less. At present the classic operation is infrequently done, and usually in cases in which for some reason the low operation would not be entirely simple.

We have now done the operation 50 times. Of these, 30 were done after a test of labor. It may properly be asked what we consider to be a test of labor. It does not seem to us that a rule may be given which will, without exception, fit all cases. A certain amount of judgment must be used in applying all surgical procedures. But of the rules which have been given, perhaps the best is that one may consider a test of labor to have been had if the cervix is dilated, the membranes ruptured, and good pains have continued, after both the above conditions have been accomplished, at intervals of not over five minutes, for at least one hour. No rule may be adhered to without exception. But a conscientious obstetrician will at least satisfy himself that delivery is not likely to occur and will not operate after a few pains.

The convalescences of these women were far smoother than those of any similar number of classic cases which we have had.

The more favorable postoperative course is due to two factors. First, the incision in the inactive lower uterine segment, which does not contract actively as does the uterine body. Second, the covering over of the incision in the uterus by the vesical flap of peritoneum and by the bladder itself, which still further prevents the migration of infective material from the interior of the uterus to the peritoneal

cavity. These factors have been discussed by so many writers that we shall not enter into them. We believe the spill of the amniotic fluid is a factor of little importance in the production of postoperative morbidity. The important cause of distention in the classic operation is the migration of bacteria or bacteria laden material through the incision into the abdomen. All women have bacteria in the lower uterine segment within thirty-six hours after delivery. If abdominal

Fig. 1.

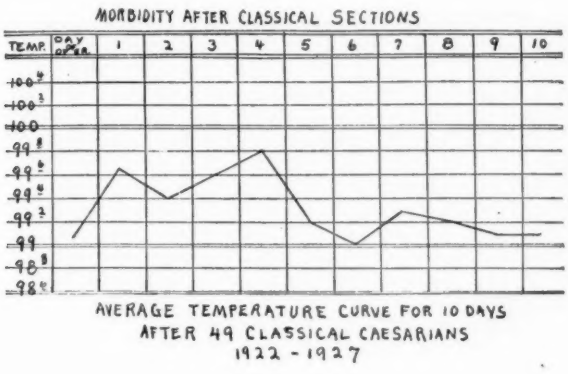
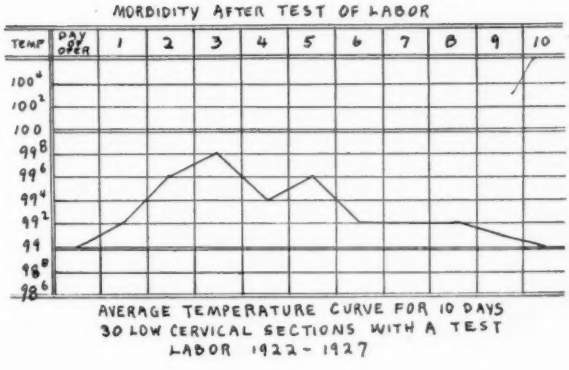


Fig. 2.



delivery is done many hours after the beginning of labor, particularly if the bag of waters is ruptured, bacteria may be there already. The strong contractions of the empty uterus, the "after-pains," grinding the edges of the recently sutured wound upon each other, cause serum or blood containing bacteria to be forced through the wound into the peritoneum. The postoperative distention is due to a low grade peritonitis which usually clears up after a few days. In cases operated upon after long labors or after operative attempts from below, the infection is a more serious one.

The invasion of the peritoneum by bacteria from the uterine cavity is avoided by the low cervical operation. It is this factor which gives this operation its greater freedom from postoperative discomfort and its greater degree of safety.

The technic which we have used is essentially that which has been described by others. After entering the abdomen the general abdominal cavity is protected by a long pad placed under the edges of the incision in a horseshoe shape, with the opening below. The vesical peritoneum is opened just below its upper border, going far enough below this point to allow for an upper flap. The bladder is stripped downward with the fingers, and held under the symphysis with a retractor. A short incision with a scalpel is made at the upper part of the lower uterine segment. This is lengthened downward with scissors. A pair of simple straight Mayo scissors is convenient for this purpose. We have not found any advantage in knives, especially devised for this step of the operation. After the incision in the lower uterine segment is made, we have found it of advantage to use an electrically driven aspirator to keep the wound clear. The face of the child is rotated to the front by the hand, a finger being placed in the mouth to facilitate this. The head is then slowly delivered with forceps which are put on with the concavity toward the symphysis.

The special forceps of DeLee devised for use in this operation, or any short forceps, may be used. The placenta is removed manually.

Should there be some freely bleeding vessels in the edge of the incision they may be caught at this time with "T" forceps which are very useful for controlling bleeding at this stage. In some cases considerable bleeding is encountered. It is nearly always controlled without great difficulty.

The incision is closed by two rows of running sutures, using number 2 chromic gut. We have found that this closes the wall of the lower uterine segment well and controls bleeding.

For a considerable time we imbricated the peritoneum in all cases. At present we imbricate only in those in which we feel that additional protection against infection is needed. In most of our cases we merely unite the peritoneal edges.

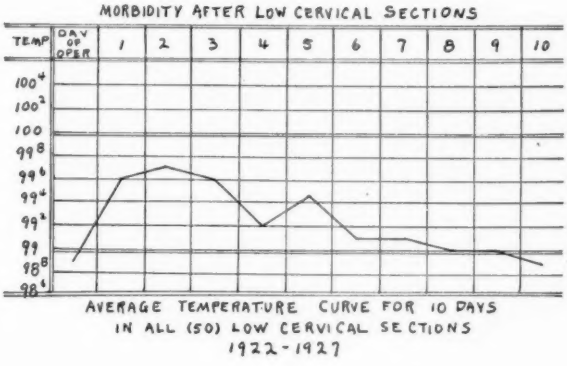
We have always in readiness instruments and gauze for packing the uterus, but up to the present time it has not been necessary to pack the uterus in any case.

It has been objected by some of those who have not favored the newer procedure that in a woman who is not in labor, or who had not been in labor long enough for the cervix to be entirely unfolded, the upper end of the incision might extend into the uterine body. It is true that in such cases the incision may extend above the upper limit of the lower uterine segment. It has been said by critics of the operation that this takes away all the theoretical advantage of the operation. It is not desired that extension into the uterine body shall occur, and its occurrence may, as a rule, be limited to the cases in which the cervix is slightly or wholly unfolded, and in these the invasion of the uterine body is rarely more than two centimeters. Whenever this occurs, attention is given to careful closure and the upper end of the wound is covered by imbricated peritoneum. Our experience has been that recovery in these cases is as smooth as in other cases. Our interest is much more concerned in the comfort and safety which experience shows our patients have than in merely theoretical considerations.

We have in 2 cases inadvertently passed the cervical rim and extended the incision downward into the upper part of the anterior wall of the vagina. The vaginal wall was opened for two centimeters in one case and scarcely more than a centimeter in the other. Contact with the vaginal cavity by hands or instruments was carefully avoided except for necessary sutures in the anterior wall. The recovery was uneventful in both cases.

Our total number of low cervical sections is 50. Of these, 30 were operated upon after a test of labor. The length of labor has averaged 21.7 hours. Of the cases undergoing test of labor, 10 ruptured the bag of waters early in labor. In these 10 cases the average length of time between the rupture of the bag and delivery was 12.5 hours. The average range of temperature in this series is indicated by the curve shown in Fig. 2.

Fig. 3.



30 Cases Having Test of Labor

Average hours in labor	21.7 hours
Number with ruptured membranes	10.0
Average number hours ruptured	12.5 hours

If we take the entire number of women delivered in the hospital from the beginning of 1922 until November 1, 1927, the time at which this report is written, the incidence of cesarean section is 1 in 41.2. This is a larger incidence than we would have if we were dealing with a series of cases the greater number of which were in a charity ward. Our private work consists each year of a considerable number of women who come because of trouble in a previous labor or who are sent by their physicians who fear abnormal labors. At one time during the past year the senior author had under observation at one time 5 women who had had disastrous experiences in former labors. All of these had lost their babies. Three of them had pelves below the normal in their measurements. Another had dense, extensive radiating

vaginal scars extending high up and diminishing the size of the vaginal vault. These 4 were delivered by section; the fifth woman was delivered by the natural route. It is possible that some of these, with a long test of labor, might have delivered vaginally. We are extremely careful in the case of a woman who has already lost a baby, to give her every possible chance of a living and uninjured child. Section is not adopted routinely in these cases, as a considerable part of them do not need it. As our service contains a large proportion of private cases, we find it necessary to be very careful of our fetal death rate. High forceps deliveries are extremely rare. During the past two years only one was done. This was by a member of the courtesy staff of the hospital. During the past four years no member of our own service has done it. A few patients are delivered by version.

TABLE I

HOSPITAL	YEARS	INCIDENCE	PER CENT	TOTAL CASES
N. Y. Lying-In	1922-3-4-5-6	1 in 33 plus	3.005	31375
Boston Lying-In	1924-5-6	1 in 28 (Including abdominal therapeutic abortions)	3.57	8540
Sloan, N. Y.	1922-3-4-5-6	1 in 22.5	4.50	8208
Chicago Lying-In	1925-6	1 in 34.4	2.08	8006
Evanston Hospital	1923-4-5-6-7	1 in 41.0	1.64	3585

There has been no maternal mortality and only one infant death. This occurred in the case of a woman with a pelvis much below normal in its measurements who had been in labor forty-four hours before operation. She was brought to the hospital at the expiration of this time. No vaginal examination had been made by her attendant, and she showed no evidence of infection. The fetal heart was audible but very rapid. To give the child a chance for life the abdominal route was chosen. The child was delivered alive but lived only an hour. The woman made a good recovery.

There had been no case in which the convalescence was sufficiently disturbed to cause serious anxiety. In one case during the past year a hematoma developed between the anterior surface of the lower uterine segment and the bladder. This absorbed spontaneously.

We feel that the low cervical operation is a valuable addition to obstetric technic. The fact that it can be used after a labor of considerable length is of itself sufficient to recommend it. It is true that it is a little more complicated than the older operation, but there is nothing about it which would trouble any surgeon who is accustomed to abdominal work. It should be used in preference to the classic operation in all women who are in labor. This should especially be so if the labor has lasted any length of time.

Our results have shown that it may with safety be used after an adequate test of labor.

The difference in the average convalescence between the low operation and the classic one, the difference all being in favor of the newer operation, causes us to believe that it is a better operation for routine use than the classic section. This opinion is based upon the first hand observation of an ample number of both methods, and it is upon such experience alone that definite statements may be made.

708 CHURCH STREET.

(For discussion, see page 295.)

THE EFFECT OF BILE SALTS UPON THE AUTOMATIC CONTRACTIONS OF THE UTERUS AND UPON THE ACTION OF PITUITARY EXTRACT DURING PREGNANCY: A POSSIBLE EXPLANATION FOR THE CAUSE OF LABOR

BY J. HOFBAUER, M.D., BALTIMORE, MD.

(With the assistance of R. C. Cumming and M. C. Rugsley)

(From the Department of Obstetrics, Johns Hopkins University)

FOR centuries the medical profession has constantly endeavored in various ways to unravel the mystery of the causation of labor, and a vast literature has accumulated upon the subject. Without detracting from the brilliance of some of the conceptions which have been advanced, the general impression prevails that most of the theories bearing on the problem are unsatisfactory and that none of them are of universal application.

In this study, I wish to direct attention to two recent papers which are worthy of comment because of their bearing on clinical facts. Dixon and Marshall pointed out that the concentration of the oxytocic substances present in the dogs' cerebrospinal fluid may be increased by the intravenous injection of ovarian extracts prepared from ovaries removed just before parturition while injections of similarly prepared extracts of corpus luteum or of other tissues failed to induce secretion of the posterior lobe of the pituitary gland. Their experiments led them to conclude that the corpus luteum exerts a dominating effect upon the ovarian function and that pituitary secretion is held in abeyance by the presence of corpus luteum. Consequently, the latter organ must play a prominent part in maintaining pregnancy. They consider that a definite but hitherto unexplained change in the ovarian secretion, associated with sudden degenerative processes within the corpus luteum at term, is the factor responsible for inducing pituitary secretion, which, in turn, renders the uterus hypersensitive and highly responsive to other forms of stimulation. In other words, according to their trend of reasoning, labor begins as the result of an "ovarian-pituitary endocrine mechanism."

Ever since its enunciation, this attractive hypothesis has aroused a great deal of interest. Nevertheless, a number of valid objections have of late been advanced against it. First, it has been shown that the degeneration of the corpus luteum is a gradual process and does not occur suddenly. Moreover, much doubt has been cast upon the specificity of the alleged stimulation of the pituitary gland by ovarian extracts by the experiments of Blau and Hanehcr, who adduced evidence to show that extracts of the liver or the spleen may have a similar effect. The chief objection, however, lies in the clinical fact that oophorectomy, from the end of the second month of gestation to its termination, does not necessarily interfere with the normal progress of pregnancy, and as many such observations have been reported, it is now generally accepted that the corpus luteum may be safely removed after the very first part of pregnancy. On the other hand, the experience of recent years indicates that the significance of the corpus luteum during this period, although still debated, is still open for determination.

Knaus, in an attempt to approach the problem of the causation of labor from another angle, studied the functional alterations of the uterine muscle in rabbits during the various stages of pregnancy. He showed that in the first half irregularity of the spontaneous contractions both as to intensity and interval predominates while during the second half the waves assume a rhythmic and regular character. Moreover, with the advance of pregnancy, the automatic contractions occur in closer sequence and, in addition to a further increase in frequency and strength of the intermittent contractions, there can be seen a definite increase in the tone of the uterine muscle and the intrauterine pressure. Consequently, some slight additional stimulus, more particularly the administration of a comparatively small amount of pituitary extract during this period, may set labor in progress; whereas it would be without effect at an earlier period. In other words, according to Knaus's conception, the uterine muscle becomes gradually prepared for the process of parturition by a constant systematic training, and he considers that the striking changes in the functional activity of the uterus during pregnancy are due to an influence exerted by the pituitary gland. Knaus bases his claim for the predominant rôle of the hypophysis as the principal factor concerned in the production of the functional alterations of the uterine muscle during the second half of pregnancy upon the well-recognized sensitizing action of pituitary extract on the uterus. The immediate onset of labor thus constitutes the final step in the course of a series of typical developments which are governed and controlled by hypophyseal action.

In view of the essential complexity of the problem under discussion, the greatest present need seems to be the consideration of two of its fundamental aspects; the tolerance of the pregnant uterus toward the product of conception on one hand, and the immediate causation of

labor on the other. For the remarkable tolerance of the uterus to the presence of the embryo and to its increasing distention during pregnancy, no suitable explanation has as yet been advanced. Clinical experiments clearly show that we have been in error in accepting the belief that it is inseparably correlated with the activity of the corpus luteum. Moreover, the hypothesis advanced by Ancel and Bouin that "the myometrial gland" should be regarded as the responsible factor is based on mere speculation. Real advance in the scientific development of the subject can be achieved only by the actual demonstration in the blood of pregnant women of some chemical or hormonic principle, which is concerned with the inhibition of excessive uterine contraction.

In the search for such a principle, my interest was aroused by recent advances in our knowledge of the biologic effects of the bile salts. The pioneer work in this respect is credited to Asher, who showed that under the influence of even small amounts of bile salts, the action of certain drugs with characteristic effects upon the autonomic nervous system would become strikingly changed, and very often completely reversed. For example, the vagus-paralyzing or depressing action of atropin on the heart could thus be converted into a stimulation; while a reversal of the stimulating effect of acetyl-cholin has likewise been demonstrated. An acceptable basis for the interpretation of such phenomena is afforded by the recognized ability of the bile salts to lower the surface tension (Asher, Rosenthal, Adler, Neubauer). Another interesting feature of the biologic effects of bile salts is their property of greatly diminishing the excitability of the parasympathetic system. The elaboration of sodium glycocholate and taurocholate is at present recognized as an intermediary stage in cholesterin metabolism, and these salts are designated by Asher as "true liver hormones."

As far as the biology of human pregnancy is concerned, reference is necessary to the recent work of Süsstrunk, and also of Kleesattel, who independently adduced evidence to show that beginning with the end of the second month of pregnancy there occurs a gradual but steady increase in the bile-acid content of the blood, which finally reaches a level three times higher than in the nonpregnant woman. The method employed for the determination of bile acids was originated by Wieland, and later somewhat modified by Frey. The occurrence of lowering of surface tension in the blood of pregnant women has been actually demonstrated by Lederer. In addition, an altered response of the pregnant uterus to adrenalin has been established by the experimental work of Dale, Cushny, Kehrer, and the stimulating effect of atropin on the small intestines in pregnant carnivora has been demonstrated by Hirz, Hofbauer, and others.

Taking all these considerations into account, we performed a series of experiments in the hope of obtaining some light on the interpreta-

tion of the above-mentioned facts by determining the effect of small amounts of highly diluted bile salts upon the spontaneous contractions of strips of uterine muscle from nonpregnant and pregnant guinea pigs. An investigation as to whether such a saturation with bile salts would alter the response of uterine strips to pituitary extract was subsequently carried out, and it was hoped that this might offer a clue toward the elucidation of the problems of both the onset of labor and of the regulation of uterine contractions during labor.

The following technic was developed. The whole uterine horn of the virgin uterus or a four centimeter long strip of the pregnant uterus was immersed in 50 c.c. Locke's solution and its spontaneous contractions recorded with a kymograph. After a lapse of a certain space of time, when the contractions had become regular in type, the response of the uterine strip to pituitary extract was tested, 3 drops of a 1/30

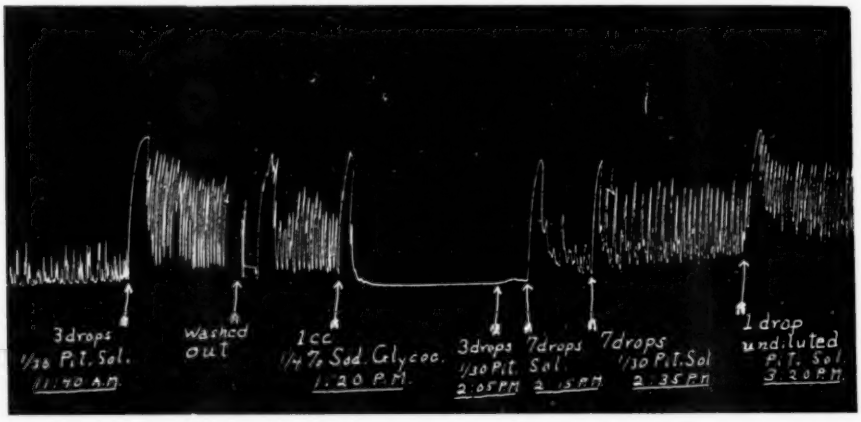

3 drops 1/30 Pit. Sol. 11:40 A.M.
washed out
1 cc 1/4% Sod. Glycoc. 1.20 P.M.
3 drops 1/30 Pit. Sol. 2:05 PM
7 drops 1/30 Pit. Sol. 2:15 PM
7 drops 1/30 Pit. Sol 2:35 PM
1 drop und. luted Pit. Sol. 3:20 P.M.

Fig. 1.

dilution of the commercial pituitary solution being used. After this was recorded, the whole preparation was carefully washed out, and the type of spontaneous contractions again recorded. Then, for the next sixty to ninety minutes, the effect of the addition to 50 c.c. Locke's solution of one cubic centimeter, and in a few experiments of two cubic centimeters, of a 1/4 per cent solution of sodium glycocholate (Merck) on the uterine activity was determined, as well as the response of the uterine strip to various amounts of pituitary extract diluted thirty times. In order to ascertain whether changes in the reaction of the preparation were concerned in the variations in the uterine contractions, Dr. Perlzweig very kindly determined the hydrogen-ion concentration of the Locke solution before and after the addition of the sodium glycocholate, but found no change whatsoever.

Since the sixteen experiments in the nonpregnant and the eight in the pregnant group yielded practically consistent results, the evidence

provided on the points under discussion may be deemed convincing. The presentation of three curves serves to exemplify the results obtained.

The tracing reproduced in Fig. 1 shows the effect upon the automatic contractions of the virgin guinea pig's uterus of the addition of 1 c.c. of ¼ solution of sodium glycocholate to 50 c.c. of Locke's solution. After a short period of stimulation, the contractions become entirely suppressed, the level of the tracing remaining beneath the base line. This relaxation of the uterine muscle could not be counterbalanced by the addition of 3 drops of the diluted pituitary solution, a dose which

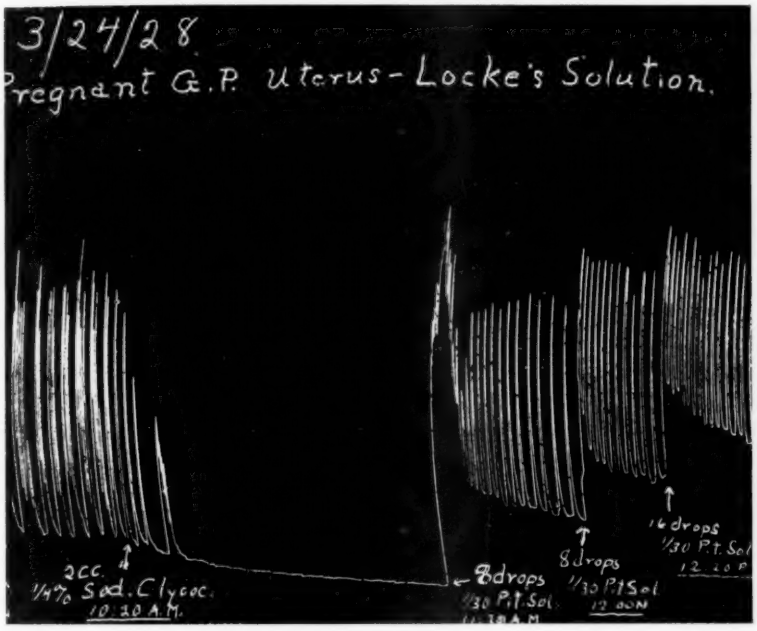


Fig. 2.

had produced a characteristic effect at the start of the experiment prior to the addition of the sodium glycocholate. Indeed, the addition of 7 more drops of the pituitary solution were required to raise the muscle tone; but even then the result was transient, and it was not until 7 more drops of the diluted pituitary solution (or 17 drops in all) had been added, that the uterine muscle regained its initial tone and the contractions occurred at regular intervals. Finally, following the addition of one drop of undiluted commercial pituitary solution, a distinct increase both in the tone and the frequency of the contractions was noted, and the uterine muscle no longer completely relaxed between the individual contractions.

The second tracing (Fig. 2) represents the influence of the addition of 2 c.c. of sodium glycocholate (¼ per cent solution) on the automatic

uterine contractions in a guinea pig in the second half of pregnancy (2 weeks before term). It should be noted that the abolition of the contractions was associated with a distinct and continuous decline of the uterine tone. Eight drops of the diluted pituitary preparation produced an immediate sharp rise of the tone with subsequent regular rhythmic uterine contractions, occurring at intervals of five minutes. The addition of 8 more drops effected a further rise in tone and a closer sequence of uterine contractions, the intervals now being reduced to three minutes. A further increase in tone and frequency of contractions, with intervals reduced to one or two minutes followed the addition of 16 more drops diluted pituitary. Accordingly, it is seen that more sodium glycocholate was required to suppress the spontaneous contractions, while a smaller amount of pituitary extract sufficed to restore them than in the nonpregnant animal.

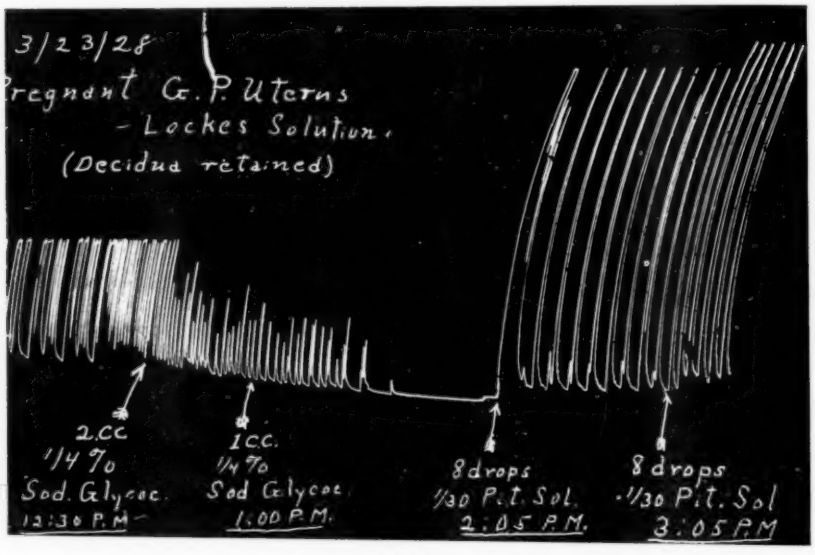


Fig. 3.

Tracing 3 (Fig. 3), obtained from a guinea pig's uterus near term, illustrates first that 3 c.c. of our sodium glycocholate solution were required to suppress completely the spontaneous uterine contractions, while a concomitant decrease in uterine tone is also noticeable. In the second place, it shows that 8 drops of diluted pituitary extract not only restored the contractions, but gave rise to a type much more violent than before, and of a higher tone. Furthermore, it is seen that the addition of a further eight drops led to an increase in tonicity, and reduced the intervals between the contractions from five to three minutes. In other words, this tracing seems to show that the effect of the sodium glycocholate is diminished while that of the pituitary extract is increased as pregnancy progresses toward term.

Several additional experiments conducted along similar lines convinced us that the saturation with bile salts likewise alters the response of the guinea pig's uterus to histamine, in that a ¼ c.c. of 1:1000 solution failed to exhibit any visible influence, and the ordinary histamine effect did not occur until a dose twice as great as usual was added.

DISCUSSION

The reactions observed tend to show that the depressing effect of bile salts both upon the tone and the contraction of the uterine muscle may be an important factor in offering an adequate explanation for the remarkable tolerance of the pregnant uterus to the product of conception and its failure to expel it as it would any other foreign body. It would accordingly appear that the action of salts of the bile acids upon uterine activity is comparable to the effect of narcotics.

The fact that the bile acids are present in the blood during pregnancy in a considerably higher concentration than in the normal woman, is an apt illustration of the alteration of the liver function during gestation. The problem of the anatomic and functional changes of the liver during pregnancy has occupied the attention of the obstetricians ever since the author, in his monograph on the "Toxicoses of Pregnancy," emphasized the presence of venous passive congestion, depletion of glycogen associated with increase of fat substances in the central portion of the lobules, and stagnation of bile as characteristic features of the "liver in pregnancy." We shall not give here the entire list of competent investigators who in the intervening years have greatly extended this field of research. Suffice it to say that the recent studies of Schmidt have fully corroborated the microscopic characteristics mentioned above. The other phase of the subject, the instability of liver function or a lowering of its reserves, is supported by a wealth of evidence contained in the publication of Hofbauer, Linzenmeier, Nürnberger, Umber, Eufinger, and others, while our knowledge of hepatic physiology during normal and abnormal pregnancy is steadily increasing. The work of recent years with pituitrin and histamine indicates to what an extent liver function is under hormonic control.

Since recent clinical investigations indicate that an increased amount of bile acids may appear in the blood as a sequel of impaired liver function, new color is lent to the conception of the altered conditions of the liver in pregnant women on one hand, and to the cause of the rise of the titer of bile acids on the other. There is documentary evidence to show that an increased pituitary secretion produces both depletion of glycogen and fatty infiltration in the center of the liver lobules (R. Coope and E. H. Chamberlain). Moreover, a similar relationship obtains regarding the action of split products of proteins on the liver cells (Hofbauer). If we recall the fact that varying amounts of fetal

ectoderm are constantly cast off from the periphery of the chorionic villi and break down in the maternal blood, it is likewise conceivable that this factor may also be brought to bear on the aspect under discussion.

The interaction of bile salts and pituitary extract in our experiments involves a mechanism of considerable interest. The records obtained run parallel to clinical facts. The most characteristic feature consists in the failure of small amounts of pituitary extract to elicit contractions of the uterine muscle after its saturation with bile acids, whereas previous control doses had proved effective. The type of contractions observed in the virgin guinea pig's uterus following the repeated administration of increasing amounts of pituitary solution closely resembles that recorded in Knaus's investigations during the second half of pregnancy. The inhibitory effect of bile salts on the spontaneous uterine contractions is also manifested in the curves obtained from pregnant animals, although the nearer term is approached, the higher becomes the concentration of bile salts required to produce this depressing effect. On the other hand, a lesser amount of pituitary solution is required to overcome the inhibition, so that late in pregnancy a dose which previously had a minimal effect now has a powerful one, and gives rise to a type of contraction suggestive of that occurring at the time of labor.

On the basis of our observations it seems clear that the pregnant uterus responds more vigorously to the stimulating principle of pituitary extract and it is equally clear that the action of the latter is conditioned by the functional state of the uterine muscle. In other words, the presence of bile salts in the muscular tissue so alters its response to pituitary solution, that, instead of a tetanic state, as would be the ordinary response of the pregnant organ to this principle, rhythmic intermittent contractions ensue, which have no tendency to expel its contents. In these observations we have a further illustration of the fact, which has been repeatedly stated in recent years by pharmacologists, that the various hormones condition each other's action.

It is not only in consequence of the clinical experience with the induction of labor at term by the administration of pituitary extract that it has been suggested that this principle continues to operate during the onset and the further course of labor. Several investigators claim to have ascertained that an increased hypophyseal secretion of an oxytocic substance occurs during pregnancy, and more particularly during labor, as measured by its concentration in cisternal liquor. Furthermore, in a few experiments conducted by us it appeared that the addition of 2 c.c. of serum obtained from parturient women to the 50 c.c. Locke's solution in which the guinea pig's uterus was suspended, produced a characteristic pituitrin effect. Finally, if one

considers the results recorded in our tracings, as well as the actual facts during labor, one can hardly escape the inference that such a controlling influence of the pituitary gland may be established.

In regard to the extent to which the data given above may be applied to the problem of the ultimate production of labor, it seems logical to assume that the activity of the pituitary may be in part responsible for it. At present, however, nothing of a positive character can be offered in explanation of its sudden onset, and additional data are essential before any final conclusion can be drawn. The work of Trendelenburg, however, which showed that electrical stimulation of the cervical sympathetic nerve increases pituitary secretion, linked with Cannon's statement that abdominal pain and also strong emotions or splanchnic stimulation tend to provoke adrenal action, may throw some light on the parallelism existing between the normal occurrences during labor and the effects of repeated doses of pituitary on the pregnant uterus, as established in this study.

CONCLUSIONS

With the fact established that there occurs a steady increase of bile salts in the blood of pregnant women, a study has been undertaken to determine their effect on the automatic contractions of the uteri of the virgin and pregnant guinea pigs.

The addition of bile salts suppresses the spontaneous uterine contractions, the effect being accomplished by the specific surface tension lowering power of the bile salts.

The relaxation of uterine tone could not be neutralized by the addition of small doses of pituitary extract which are otherwise effective.

Large amounts of pituitary extract produced strong uterine contractions, equal in character to the contractions occurring during labor.

Note: Our recent observations concerning the effect of highly diluted bile salts on the automatic contractions of the ureter show an increase in the intervals and a decrease in tone. The bearing of these facts on both the atony and the sluggish action of the ureter of the pregnant woman, and the counteracting effect of adrenalin are discussed in another paper (*Journal of Urology*, xx, No. 2). For further information concerning the conditions of the ureter during pregnancy, the reader is referred to Hofbauer's Monograph on Pyelitis in the March number of the *Johns Hopkins Hospital Bulletin*, 1928.

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SOME POINTS IN VETERINARY PRACTICE OF INTEREST TO THE GYNECOLOGIST*

By G. L. Moench, M.D., New York, N. Y.

ON SEPTEMBER 12, 1927, I had the privilege of attending at Philadelphia the meeting of "The Society for the Study of Diseases of the Genital Organs of Domestic Animals." The program was excellent, thoroughly scientific, and represented almost throughout original work.

Perhaps my most outstanding impression, however, is of the excellent records and case histories possessed by the veterinarians. Our own records, even our best, would certainly not receive more than a Class "B" rating were the American College of Surgeons to apply veterinary standards. While it is of course true that veterinary records are more easily obtainable than ours, this alone still does not seem to me to be an entirely adequate explanation. I hope it will not sound too cynical if I express the belief that one of the reasons for the better records in veterinary medicine is to be found in the fact that in breeding animals the question of money plays such an important part, whereas the improvement of the human race, not being directly coupled with financial emoluments, is a less stimulating and exhilarating pastime.

Due to their fine case records and to the number of accurately controlled and controllable cases, veterinarians are able to demonstrate facts which are not only often disregarded, but at times even unknown in human medicine.

Dr. W. L. Williams, for instance, in his very fine paper on "The Significance of the Duration of Pregnancy in the Mare and Cow"—a paper which, by the way, I would recommend to every obstetrician and gynecologist for detailed study—brought out very many interesting points which I wish to touch upon briefly. Taking two of the best studied domestic uniparous animals, the cow and the horse, he finds the average duration of pregnancy in these two species to be around 285 and 334 days respectively with a tendency in the cow toward premature labor, and in the mare to go past term. Statistics for the cow show that the more services per achieved calf are required, that is, the lower the fertility or rate of conception the shorter on the average the duration of pregnancy will be and naturally the higher

*Read at a meeting of the New York Obstetrical Society, February 14, 1928.

the rate of abortion. Conversely, the lower the rate of conception in the mare the longer generally the period of gestation. This may seem paradoxical but as Williams restates it: "The higher the rate of conception the more nearly the average duration of pregnancy will approach the ideal of 334 days for the mare and 285 days for the cow." That is, the average duration of pregnancy is a direct indicator of the fertility of the particular animals and, if the cows remain the same and healthy, the fertility of the bull is directly indicated by the length of the gestational period in the cows served by him. The most fertile bulls will have calves born around 285 days and the less fertile ones after 280 to 270 days or even less. In stallions, on the other hand, the lower fertility will be evidenced by the increased length of gestation in the mare over and above the ideal period of 334 days.

I have already pointed out in a previous paper read in this Society that habitual abortions and, of course, premature labors in some cases may perhaps be due to the male instead of the female. Veterinarians again, however, have gone much deeper into this subject than we. In human medicine we are apt to consider the prematurely born infant as particularly prone to ills of all kinds, but once the child has survived this early period the fact of its premature birth is considered insignificant and promptly forgotten. Here, however, is a very large field for improvement of our statistics and our knowledge of sterility. In breeding animals it has been shown that prematurely born calves are seldom good breeders later on, often even being sterile. May not then some of the human cases of primary sterility be explainable on the same basis? I have of late questioned sterile men and women as to whether or not they had been born prematurely, but found in most instances that the patients had no knowledge whatsoever of the subject.

Granted, however, that we consider premature birth as of some importance we certainly regard the overcarried child generally as particularly fortified to overcome life's vicissitudes. We think of him nearly always as a large overweight baby, who has only the increased possibility of dystocia to face. It is true DeLee[1] reports a child carried three weeks over term who weighed only three and a half pounds, but such a case is regarded as a great exception. In contradistinction to the generally accepted opinion regarding overcarried children, the animal breeder regards overcarried offspring with no more favor than he does premature animals and finds that they also often turn out to be sterile. Furthermore, although carried past term, they are frequently underweight. It would not only lead too far here to discuss all the possible theoretical explanations of these various findings, but would be aside from my purpose at this time, which is

solely to call attention to these commonly accepted and recognized opinions of the veterinarians and to bring out a discussion of the subject in this Society.

Before I leave the subject of sterility and fertility, however, I want to mention the interesting data presented by Conklin, of Quebec, regarding the fertility of the domestic cock. Conklin was especially concerned with the influence of the sexual health of the rooster on the fertility and hatchability of the eggs. He found that weakening the sexual health of the rooster by excessive sexual use or otherwise, resulted in a slight increase of the early death rate of the embryos in the eggs and in a tremendously increased late death rate. At the same time Conklin found, in principle at least, the same morphologic sperm changes which Williams and Savage have found in bulls and I have seen in the human male.

The last point I wish to touch upon before closing is the question of the bacterial content of the female genital tract above the external cervical os. In human medicine the bacteriologic sterility of the normal cervical canal, uterine cavity, and fallopian tubes has come to be accepted without question. It is true that Winter[2] found bacteria 11 times in 40 tubes from 31 patients, but since usually only one or two colonies grew in the cultures, this bacterial growth was considered the result of contamination. Winter, however, found bacteria of various types frequently around the region of the internal os in extirpated uteri and so considered the uterus sterile only above this region. At the same time he found that the pathogenic bacteria present, staphylococci and streptococci, etc., were of decreased virulence. Bumm[3] found bacteria in 15 cases of so-called endometritis (usually glandular hyperplasia of the endometrium) but considered the bacteria as concomitant to the disease and not its cause. Boige[4] found bacteria in some uteri but considered them the result of contamination. Other authors obtained similar results and gave similar interpretations. Gottschalk and Immermann,[5] however, found bacteria in 39 out of 60 cases of endometritis corporis and also found that bacteria after postpartum infections might remain a long time in the uterus in a quiescent state. Menge,[6] in contradistinction to most of the authors mentioned, found bacteria only six times in 73 corpus and 29 cervical examinations made on 75 uteri. Of these six cases three were carcinomas of the cervix associated with pyometra, one a cervical carcinoma, and one a degenerated fibromyoma. Menge decided that the genital tract a very short distance above the external os was sterile, a view which is the generally accepted one today.

Nevertheless we see that there is no uniform agreement regarding the bacteriologic content of the human female genital tract above the external cervical os, the generally accepted opinion of the sterility of this area being achieved only by calling any bacteria found here a con-

tamination. In veterinary medicine also there is no uniformity regarding this matter, but the general trend today is to consider bacteria as usually present in the cervix and uterus but in a less virulent form so that symptoms are caused only when some added factor enables the bacteria to grow. The fact that a bacterial content of the normal uterus is so contrary to human medicine is answered by the veterinarian, and perhaps justly so, by pointing out that the facilities for doing such research work in animals are so immeasurably greater than in human medicine that their results are more liable to be correct than ours. Beller,[7] for instance, in extremely careful bacteriologic studies, has shown bacteria not only in the uterus but inside of the intact fetal membranes, that is, in the allantois and amniotic fluids and even in the umbilical cord and placental vessels. Furthermore, the weight of evidence points to the fact that these bacteria do not come from the maternal blood stream but from the previously infected endometrium. Beller's findings corroborate the extensive work of Sohnle[8] and his collaborators, Hellendall[9] and Hofstadt,[10] and is in accordance with the work of Albrecht,[11] who out of 12 bovine uteri in advanced stages of gestation found only 3 free from bacteria. Beller comes to the conclusion that bacteria of various types are regularly present in the healthy pregnant and nonpregnant uteri but cause no recognizable injury because either their virulence is lowered or the resistance of the tissues is sufficiently high to prevent illness. Trouble occurs only when the vitality of the female becomes lowered in which event abortion may take place if the animal is pregnant. Veterinarians feel that the bacterial infection of the uterus and resulting from it, that of the placenta, causes such an enormous fetal mortality that it exceeds by far the death rate of the offspring for any extrauterine period of equal length. Thus between placental disease and the health and life of the pregnant female and of her intrauterine young there is an intimate interrelation. At certain epochs, like the period of gestation and estrum, there is a change in the efficacy of the reaction of the maternal organism to bacterial insult which needs to be overcome. If the necessary increased resistance fails to develop, the result is premature expulsion of the fetus, retained placenta, or even sterility. These statements are conclusions drawn from careful research work by competent observers in veterinary medicine and cannot be ignored by gynecologists. It seems to me that the whole field of the bacterial invasion of the uterus, both pregnant and nonpregnant, as well as during menstruation, is in need of a very careful revision and reexamination. The possibility of uterine infection causing abortion, as in the case of some of the domestic animals, must be especially carefully considered, for the more one studies the genital tract and its diseases in animals, the more evident the marked similarity to gynecology becomes.

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30 EAST FIFTY-EIGHTH STREET.

(For discussion, see page 292.)

CAUSES AND PREVENTION OF STRICTURE AND OCCLUSION OF THE CERVIX UTERI*

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THE literature on cervical stricture has not been brought to date. There is practically nothing approaching a thorough consideration of the subject in the writings of the last two decades. In the light of recent radical changes in our conception of the nature of cervical pathology and treatment, the older literature in many instances is no longer pertinent. We believe that the subject merits careful and thorough consideration in order to crystallize our present knowledge of the pathology following cervical inflammation and injury. On this structure we would like to establish a rationale for the therapy of cervical disease, in the interest of prevention of cervical stricture which is prone to follow certain forms of therapy. We wish, by tracing the pernicious effects of older methods of treatment, to emphasize the uniformity with which scar tissue occurs as the pathologic basis of the strictured and undilatable cervix; to minimize recourse to such diagnoses as "functional" or "spasmodic" contraction and to urge the adoption of revised methods of cervical therapy.

There has been no question in regard to the occurrence of complete occlusions of all or part of the cervical canal outside of pregnancy. The occurrence of complete occlusions during pregnancy, however, has been denied by well qualified observers (Velpeau, Hantin, Baudeloque, Denman, Dewees). In the current edition of William's *Obstetrics* we find the statement that "Schroeder was probably right in stating that

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the so-called conglutinatio orificii externi is simply due to a very small and resistant opening." In a later paragraph, referring to cicatricial contractions, however, Williams says, "In two of my patients, cesarean section was necessary on account of complete atresia of the external os." After a study of the literature, there can be no question as to the occurrence of complete occlusion during the course of pregnancy, yet we caution against the diagnosis short of absolute certainty and submit the following case of one of us (Mathieu) to show that even after the most careful and painstaking search for a cervical canal, both from below and above (Porro section), one may be mistaken in supposing that there is a complete occlusion.

The patient, Mrs. B., was forty-three years old, a primipara, married eighteen years without pregnancy, and had taken no precautions against pregnancy for many years. The only factor of importance in the past history was a right ovarectomy five years previously. The menstrual history was entirely normal. There was considerable nausea during the first three months of pregnancy.

The abdominal findings were those of a normal six months' pregnancy. The pelvis was roomy and normal. The perineum was high and firm. From bimanual examination at six months, it was thought that there were small fibroids, a large cyst of the cervix, and no demonstrable cervical opening. Two weeks later, no opening could as yet be demonstrated, and the cyst of the cervix had enlarged considerably. A month later the cyst on the cervix had increased considerably in size, being as large as a lemon and extending over its posterior surface was a vein with a diameter of about 2 mm. Neither with the speculum and probe nor with the finger could the external os or any sign of a cervical opening be found. Because of the size of the fetus, the presence of the cervical cyst with the large vein on its posterior surface and the apparent stenosis of the cervix, together with the fact that the patient was a primipara forty-three years of age, a cesarean section at term was decided upon. August 19 (about seven weeks later) the cervix (per rectum) was as before. The McDonald measurement was 36 cm.

On September 29, two days before estimated term, an elective classic cesarean section was commenced, and completed as a Porro section because of placenta accreta which was later substantiated by pathologic examination. An effort was made to find an opening in the cervical canal but none was apparent. On the fourth day following operation there was slight serosanguineous drainage from the vagina. By the eleventh day vaginal drainage was well established and vaginal examination showed the cervical origin of the bloody discharge, definitely ruling out the existence of a complete occlusion. Mother and baby were discharged in good condition. Subsequent examination revealed the gradual shrinking and virtual disappearance of the cyst of the cervix.

We have reported the case here because, as far as we have been able to find in a study of the complete literature, it is one of four cases of apparent cervical occlusion where the fundus has been removed, leaving the cup-shaped lower uterine segment, in which, during a careful search, no trace of an opening into the cervical canal could be found. In another case recently done by DeLee (personal communication) no opening could be found during pregnancy because of postoperative scarring, but at the Porro section an opening the size of a

small lead pencil was found. We have found reported nineteen cesarean sections for cervical atresia, but in the fifteen cases where the fundus was not removed no opportunity as favorable as this was presented to verify the occlusion from above. We have no report to the effect that careful search has been made following classic or low cervical section, but the probabilities are that this has been done.

In the Porro section recently reported by Wilson of Brooklyn, there was a definite cervical occlusion. The author writes to us that there followed no sanguineous discharge which could be considered of cervical origin, and that at operation "no sign whatever of a canal was found, although not more than one-half inch of cervix was left; however, a probe was not inserted from above because of the need for haste due to the poor condition of the patient."

In answer to a question regarding another case, DeLee writes, "This was a woman, not syphilitic, who had had a previous puerperal septic process and as a result the whole vagina had scarred over, that is, what was left after the ulcerative process has been completed, and part of the vagina had sloughed away. She had also a rectovaginal fistula. There was hardly an opening to be found big enough to admit the point of a probe and at the time of operation, when I amputated the uterus, I could not find the opening that led into the vagina. I therefore made a low amputation of the uterus down to and almost into the scar in the vault of the vagina. There was no discharge after the operation, it healed by primary union."

In one case pregnancy is reported to have occurred during an amenorrhea apparently due to cervical occlusion. In this case, (Van deWarker) the patient was under observation "for many months by several physicians," with the signs and symptoms of complete occlusion. The enlargement of pregnancy was taken for hematometra until the fetal movements became unmistakable. There was complete occlusion at term. The method of delivery is not specified. If this case is accurately reported, we are constrained to believe that impregnation can occur through a cervical canal too small in caliber to permit the escape of menstrual products. We simply submit this material as of interest and do not commit ourselves. Simpson in 1831, performed a postmortem examination on a patient who died as a result of cervical atresia. Dr. Simpson says, "On dividing the uterus, from the fundus downward it was found that the growing together of the sides of the os uteri, leaving no vestige of a passage, was the result of mischief occurring in a former labor."

From these, and at least nine other observations, we are convinced of the occurrence of complete cervical occlusions during pregnancy, but admit that error in diagnosis is easy, even under conditions peculiarly favorable to careful examination.

Because of limited space, we are unable to include here a description of the increasing literature of the latter nineteenth century on this subject. We have appended a chronologic bibliography and graphs of the incidence of cases due to the various etiologic factors. A glance at this data (Fig. 1) will show that there began about 1860, with the work of DePaul and of Ozo, a considerable increase in interest in cervical stricture. Controversy is the great stimulant, and we find that with the development of two schools of cervical operations (trachelorrhaphy versus amputation) and the use of caustics, cervical therapy

became a storm center. It it certain that disease, and injury to the cervix from childbirth, must always have operated to cause cervical stricture. But the introduction of new and radical procedures for the cure of cervical pathology in general certainly increased interest and quite definitely increased the actual incidence of cases. In the words of Pinard, "The results of the treatment were too often worse than the original disease." There arose the advocates and opponents of cervical operation, and the use of caustics and cautery gained its champions and accusers. Also, there was controversy between the champions of the two methods. The result was that the cervix came

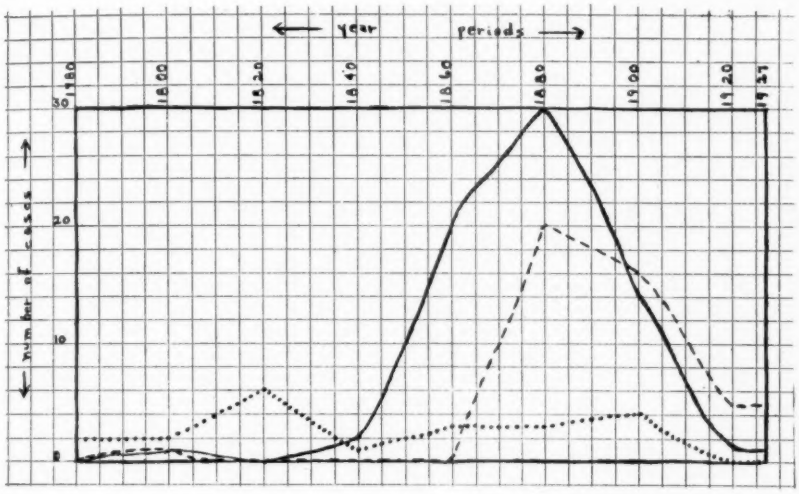

Fig. 1.—Incidence of cervical stricture following the use of caustics (———), operation (------), and obstetrical trauma (. . . . .).

These curves are compiled from all the available case reports of stricture of the cervix, but include only those in which the stricture was the obvious result of one of the foregoing procedures. Doubtful cases and those due to other factors have been eliminated. The striking feature is the rather constant curve for stricture resulting from obstetrical trauma as opposed to the sharp rise and fall of cases due to caustics and operation.

This increased incidence corresponding to the periods of maximum popularity of such methods is indicative of the important rôle of these methods of attempted therapy in the causation of serious cervical pathology. The subsequent fall in the number of cases due to caustics corresponds closely with the discontinuance of the use of this type of therapy, while the later and less radical drop in the number of cases following operation is effected by a less promiscuous use of cervical operations and by a clearer understanding of the contraindications.

in for its hey-day in the public eye, and has not before or since achieved such prominence in medical literature (1883-1904).

It is discouraging to have to admit that after a careful survey of all the available material, we feel sure that for a considerable period the majority of cases of true cervical stricture was due to methods meant to cure cervical disease. During this time, the congenital cases, and those due to obstetric injury or disease, decreased notably in their percentage of the total number of cases.

A better understanding of the anatomy and pathology of the cervix, together with the advent of the Sturmdorf tracheloplasty and the use

of linear cautery, has caused a complete revision of ideas in regard to treatment. Topical applications, tampons, and the like have no place. The use of caustics has been practically eliminated. The place of diathermy is not yet established. For the treatment of erosions, tears with ectropion, and the milder forms of endocervicitis, we have an efficient method in linear cautery (which we believe superior to radium). For the more serious distortions and infections which will not yield to cautery, there is the Sturmdorf tracheloplasty. Our confidence in the use of this armamentarium is so great that we would tend to assign failures to faulty technic.

CONCLUSIONS

The literature on stricture and stenosis of the cervix uteri needs revision. From observation of cases and a study of the literature, certain points of interest have been developed in the following order:

1. The existence of complete occlusion (or obliteration) of the cervical canal during pregnancy is clearly established. Such a process, however, could become complete only after impregnation had occurred. The clinical differentiation between complete occlusion and advanced stenosis may be difficult or practically impossible.

2. A study of the reported cases shows clearly that methods meant to correct cervical pathology (i.e., operation, caustics, cautery) are responsible for a notable increase in the total number of cases of true cervical stenosis, as well as for a definite relative increase in the number of cases following this type of therapy as compared to the number due to disease or obstetric injury.

3. A detailed consideration of the use of caustics and certain types of thermocautery gives authority to the modern conception that there is little or no place for this generally pernicious type of therapy in our modern armamentarium. However, from our own experience and the somewhat scant literature available, we feel that the accepted use of so-called "linear cautery" is well justified.

4. A painstaking analysis reveals that most authorities fear dystocia in pregnancies following both classic amputation and trachelorrhaphy, regardless of the skill used in operation. Stricture following their use is due to scarring from faulty coaptation of tissues, or to postoperative infection. With the advent of the linear cautery, the indications for operation on the cervix have been reduced to a minimum. Any operation which does not minimize the danger of infection by the removal of infected portions of endocervix is both inadequate and dangerous. There is favorable accord in regard to the use of the Sturmdorf tracheloplasty.

5. The obstetric significance of this and additional material will be considered in a subsequent paper under the heading of "The Rigid and Stenosed Cervix in the First Stage of Labor."

SENSITIZATION OF GUINEA PIGS PER VAGINAM

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Introductory.—Sewall[1] in a paper published in *Science*, October 8, 1925, entitled "*The Rôle of Epithelium in Experimental Immunization*" called attention to certain extremely interesting and suggestive findings in connection with some studies on anaphylaxis and immunization. He found that the well-known phenomena of anaphylaxis and anaphylactic shock after an injection of a foreign protein which is followed by a second injection of the same protein after an interval of rest, can be produced by applying proteins to the mucous membranes of the nose. After a series of daily injections or insufflation of small quantities of horse serum into the nostrils of the guinea pig, he could produce anaphylactic shock if the animals were allowed a period of rest and then were given an injection of the same serum. These experiments demonstrate conclusively the absorption of foreign protein by the nasal mucous membranes and are of great interest in connection with study of hay fever and bronchial asthma in men.

In view of the above discoveries of Prof. Sewall it occurred to me that it might be of interest to inquire as to whether absorption of protein would occur in a similar way through the vaginal epithelium. This was especially desirable in view of the fact that foreign protein normally comes in contact with this mucous membrane after cohabitation.

Method.—Experiments were conducted on guinea pigs, which are the animals best adapted for such studies, and because normal horse serum offered a complex of antigens most convenient for use.

The procedure employed was as follows: Healthy female guinea pigs, both virgin and nonpregnant parous ones were selected and given daily injections or instillations of horse serum into the vagina. The instillations were conducted for periods varying from seven to fourteen days and the quantities of serum introduced ranged from 0.2 to 0.5 c.c. The instillations were made with an ordinary eye dropper without any injury to the mucous membranes. After the series of preparatory or preliminary injections or insufflations were carried out the animals were given a period of rest from nine to twelve days and then were ready for final study. The final test consisted in injecting the animals with horse serum varying in quantity from 0.5 to 1 c.c. and noting whether any anaphylactic shock or other signs of allergy were manifested. The injections were made in some animals subcutaneously, in others intraperitoneally, and in still others directly into the heart in which case the animal was first put under a light ether anesthesia.

Results.—The results obtained were very clear cut and striking. Table I gives a summary of the findings in case of ten such guinea pigs

TABLE I

NO. OF EXPERIMENT	PRELIMINARY TREATMENT	FINAL TEST	RESULT
Guinea Pig I	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 9 days' rest 1 c.c. of horse serum.	Sneezing, rubbing of nose, bronchial breathing, relaxation of sphincter, twitching and dyspnea, partial paralysis in 15 minutes.
Guinea Pig II	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 11 days' rest 1 c.c. of horse serum.	Sneezing, scratching of nose, twitching of muscles, bronchial breathing, flopping of ears, paresis of hind legs, convulsions and death in 20 minutes.
Guinea Pig III	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 11 days' rest 1 c.c. of horse serum.	Sneezing, scratching of nose, twitching of muscles, bronchial breathing, flopping of ears, paresis of hind legs, convulsions and death in 25 minutes.
Guinea Pig IV	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected 0.75 c.c. of horse serum subcutaneously after rest of 11 days.	Twitching of abdomen and jaw muscles, blinking of eyes and flopping of ears, sneezing, rubbing of nose, bronchial breathing, slight depression, gradual subsidence of symptom after half hour.
Guinea Pig V	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected intraperitoneally after 11 days' rest 1 c.c. of horse serum.	Scratching and twitching of nose, twitching of ears, bronchial breathing, paresis.
Guinea Pig VI	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected slowly into heart under ether 1 c.c. horse serum after rest of 11 days.	Convulsions and death in three minutes.
Guinea Pig VII	Vaginal instillation daily for 8 days of horse serum 0.5 c.c.	Injected after 11 days' rest in peritoneum 1 c.c. of horse serum.	Protrusion of eyes, scratching of nose, bronchial breathing, flopping of ears, depression, convulsions in 30 minutes, recovery.
Guinea Pig VIII	Vaginal instillation daily for 14 days of 0.5 c.c. of horse serum.	Injected intraperitoneally after rest of 10 days 1 c.c. of serum.	Convulsions and death in 5 minutes.

which were previously sensitized. Ten other protocols in the same table give the results in control experiments. It will be noted that when normal control guinea pigs were given an injection of even as much as 1 c.c. of horse serum either subcutaneously or into the heart, no effect whatever was produced and there were no signs of anaphylactic shock. Several controls were purposely made in order to produce, the classic picture of anaphylactic shock. In these controls the animals were given injections by needle of serum, and subsequently after a period of rest received another dose of the antigen. It will be noted that the picture obtained in case of the animals sensitized

TABLE I—CONT'D

NO. OF EXPERIMENT	PRELIMINARY TREATMENT	FINAL TEST	RESULT
Guinea Pig IX	Vaginal instillation daily for 14 days of 0.5 c.c. of horse serum.	Injected subcutaneously 1 c.c. of horse serum after 10 days' rest.	Bronchial breathing, rubbing of nose, depression, paresis of hind legs.
Guinea Pig X	Vaginal instillation daily for 14 days of 0.5 c.c. of horse serum.	Injected subcutaneously 1 c.c. of horse serum after 10 days' rest.	Bronchial breathing, rubbing of nose, depression, paresis of hind legs.
Guinea Pig XI	Normal control, no previous sensitization.	Injected subcutaneously 1 c.c. of horse serum.	No effect.
Guinea Pig XII	Normal control, no previous sensitization.	Injected intraperitoneally 1 c.c. of horse serum.	No effect.
Guinea Pig XIII	Normal control, no previous sensitization.	Injected subcutaneously 2 c.c. of horse serum.	No effect.
Guinea Pig XIV	Normal control, no previous sensitization.	Injected intraperitoneally 1.5 c.c. of horse serum.	No effect.
Guinea Pig XV	Normal control, no previous sensitization.	Injected in heart 0.5 c.c. of horse serum.	Slight depression, rapid recovery, no anaphylaxis.
Guinea Pig XVI	Normal control, no previous sensitization.	Injected in heart 1 c.c. of horse serum.	Slight depression, rapid recovery, no anaphylaxis.
Guinea Pig XVII	Sensitized by injecting daily 0.5 c.c. subcutaneously for 7 days.	Injected subcutaneously after rest of 10 days 1 c.c. of horse serum.	Sneezing, scratching of nose, paresis of hind legs, bronchial breathing, twitching of muscles.
Guinea Pig XVIII	Sensitized by injecting daily 0.5 c.c. subcutaneously after 7 days.	Injected intraperitoneally after 10 days' rest 1 c.c. of horse serum.	Sneezing, scratching of nose, paresis of hind legs, bronchial breathing, twitching of muscles.
Guinea Pig XIX	Injected slowly 1 c.c. horse serum into heart.	Injected 1 c.c. in heart after rest of 10 days.	Convulsions and death in 5 minutes.
Guinea Pig XX	Injected slowly 1 c.c. horse serum into heart.	Injected subcutaneously after 10 days' rest 1 c.c. of horse serum.	Bronchial breathing, depression, sneezing and rubbing of nose, paresis.

per vaginam was exactly the same as the classic picture of anaphylaxis obtained by direct injection of horse serum into the tissues with a needle.

The progressive symptoms obtained in most of the animals were as follows. When the guinea pigs sensitized *per vaginam* were injected with the antigen, one of the earliest signs noted was a peculiar twitching of the muscles of the abdomen and of the posterior portions of the body. Sneezing and rubbing of the nose occurred in almost every experiment. In some cases the rubbing or scratching of the nose was very violent. The animals had a tense and watchful appearance, the eyes in many cases showing a definite protrusion. One of the most

characteristic signs of anaphylaxis noted in these experiments was the peculiar respiration. The respiration became deeper and jerky, in other words, there was dyspnea. On listening to the breath sounds with a stethoscope definite wheezing and bronchial breathing were heard. Such was not the case in normal control animals. These first signs of shock or anaphylaxis were followed by spasmodic movements throughout the body. There was a noticeable twitching of the jaw muscles, the animals were depressed and were lying down on the side and a definite weakness and even paralysis of the hind legs was noted in severe cases. These signs and symptoms in some of the animals were followed by generalized convulsions and finally death. A peculiar early symptom noted in some of the animals was a twitching or twirling or flopping of the ears. The gravity or severity of the symptoms varied. It was greater in the animal injected with the antigen directly into the heart, and it was not as severe when a smaller dose of the antigen was administered. The most remarkable feature of the whole injection was that in every one of the ten experiments made there were definite signs of anaphylactic shock; which proved conclusively that the introduction of the serum into the vagina was followed by more or less absorption of the foreign protein by the animal.

DISCUSSION

About ten years ago I published a study concerning absorption of drugs and poisons through the vagina in which I showed that a large number of drugs, alkaloids, inorganic salts, organic esters, antiseptics, can be and are easily absorbed through the vaginal wall. Such experiments were conducted by physiologic and chemical methods.[2] A review of the clinical and toxicologic literature made in that connection revealed also that poisoning through the vagina in humans of a grave character is not at all rare. Recently Robinson reported and confirmed some of those findings and also found some other drugs which are easily absorbed through the vaginal mucous membranes.[3] The results of the present investigations indicate that not only can drugs and poisons in the accepted sense of the words be absorbed through the vagina but also various proteins and more particularly blood serum. Sewall in the work quoted above found that he could not only produce allergic symptoms by nasal sensitization of his guinea pigs but that by selecting the proper dose and the amount of antigen given as well as spacing the period of rest, he could produce also a protective action in some of his animals. This, of course, is quite logical and in line with other experiments in anaphylaxis and immunization work. In the present investigation the author did not carry out any extensive observations along this line, but a few experiments made by introducing very small quantities of serum for long periods of time seemed to indicate that such a protective action was occasionally produced. The present investiga-

tion is of interest not only from the physiologic and pharmacologic point of view, but also from the standpoint of social hygiene and eugenics. The above experiments seem to demonstrate that normal physiologic cohabitation is essential for the fertilization of the ovum but also is conducive to "merging" or "union" of the mates in a larger sense of the word, for the experiments made on guinea pigs using horse serum as an antigen have shown that such guinea pigs can be sensitized by the instillation of the serum into the vagina.

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3420 AUCHENTOROLY TERRACE.

MESENTERIC LIPOMATOSIS AND MEGACOLON, WITH MUSCULAR ATROPHY OF THE ABDOMINAL WALL*

REPORT OF A CASE

BY WALTER T. DANNREUTHER M.D., F.A.C.S., NEW YORK

MRS. E. J., aged forty-four, was referred with a diagnosis of ovarian cyst, lipomatosis of the abdominal wall, and umbilical hernia. The patient entered the Post-Graduate Hospital on January 6, 1927, but in view of the fact that I could not verify the diagnosis of ovarian cyst, and a careful preoperative study of the patient seemed desirable, operation was deferred until January 11th. The essential points in the history and physical examination are as follows:

The family and previous personal history are irrelevant, except that the patient survived an attack of lobar pneumonia three years ago. Menstruation was established at sixteen, and has always been characterized by long intermenstrual intervals, varying from four to twelve weeks. The flow has been painless and of seven days duration from the time of onset. She married young, bore five children normally, had no miscarriages, and never complained of pelvic symptoms. For the past eight years there has been a gradual, persistent, symmetric, painless enlargement of the abdomen, which finally attained such great size that the weight of the pendulous overhang caused the patient to fall to the floor or street on several occasions. She was never comfortable in any position, and readily accepted the suggestion of operative interference. She did not suffer from constipation, backache, headache, dyspnea on exertion, edema, nervousness, palpitation, or any other symptom of consequence.

On physical examination, the nutrition and muscular development of all parts of the body other than the abdomen seemed normal in every respect. There was no evidence of emaciation or edema. Weight 172 pounds; height 151.5 cm.; pulse 80; blood pressure 134/78; urine findings normal; blood count showed 4,430,000 red blood cells, 10,600 leucocytes, and a normal differential count; phenolsulphonephthalein test demonstrated excellent renal function; chemical examination of the blood revealed normal urea nitrogen, sugar, chlorides, and carbon dioxide combining power; basal metabolism thirteen-plus.

*Read before the New York Obstetrical Society, January 10, 1928.

The abdomen appeared excessively obese and overhung the pubes to a considerable degree (Fig. 1). The entire surface was somewhat tense without much thinning of the overlying skin. The umbilicus was flattened and rather prominent, suggesting the probable existence of a small umbilical hernia. On deep palpation a non-sensitive, indefinite mass could be palpated just below the umbilical region, which seemed rounded and mobile. It did not have the definite outline of an ovarian cyst, however, and could be displaced but very little (this was probably the omentum). The abdominal wall could not be picked up by the examining hand, and gave the impression of tremendous thickness. Roentgen-ray examination of the gastrointestinal tract revealed nothing significant except what was interpreted as a general atony and dilatation of the colon.

Fig. 1.

The contemplated operative procedures consisted of a wide lipectomy of the abdominal wall, repair of the umbilical hernia, and a thorough intraperitoneal exploration. Hence, my first incision was a generously wide transverse cut across the entire width of the abdomen, which was intended to be the upper limit of the resection of fat in the abdominal wall. Before I realized it, the scalpel had traversed the skin, fascia, and parietal peritoneum, deeply wounded the omentum, which fortunately laid immediately beneath the line of incision, and nicked the descending colon. The entire density of the abdominal wall was then seen to be no more than half an inch in thickness, and not a trace of muscle fibers could be found from flank to flank. The omentum was somewhat short and contained an average amount of fat only. The intraperitoneal exploring hand disproved the

diagnosis of umbilical hernia. The entire colon was huge in size, and its walls were greatly hypertrophied, but no redundancy was apparent. The mesentery everywhere contained large masses of fat and constituted the greater part of the bulk of the abdominal contents. After carefully repairing the wounds in the descending colon and omentum, the pelvic organs, stomach, gall bladder, liver, spleen, and kidneys, in turn were systematically palpated, without discovering any further abnormality. The long transverse abdominal incision was closed in layers. The patient was confined to bed for eighteen days and discharged from the hospital four days later. During the postoperative period, a neurologist and an internist were invited to see the patient in consultation, but neither one offered any diagnostic or therapeutic suggestions.

Since the operation last January, a further increase in the size of the abdomen has added to the patient's distress, and I must confess to a sense of humiliation that I subjected her to an unnecessary operation and can contribute nothing to her comfort now. The preoperative diagnoses of lipomatosis of the abdominal wall and umbilical hernia were both wrong, and the correct pathologic diagnosis is mesenteric lipomatosis and megacolon, with muscular atrophy of the abdominal wall. It is logical to presume that the adiposal dystrophy is due to a pluriglandular endocrine disturbance, with probably a definite hypopituitarism as the chief factor. I admit, however, that I am at a loss to explain the biochemical factors which were responsible for this acquired anomaly, and am entirely in the dark concerning the remedial measures which might relieve this patient's physical discomfort.

580 PARK AVENUE.

(For discussion, see page 286.)

REPORT OF A CASE OF CONGENITAL SEXUAL ANOMALY DEVELOPMENT*.

BY MARY PAULINE JEFFERY, M.D., VELLORE, SOUTH INDIA

(Professor of Anatomy, the Union Missionary Medical School for Women)

A YOUNG man, a native of Southern India giving his age as eighteen but appearing not more than fourteen, complained of pain in the region of the left inguinal canal. The pain was not severe and had been present for several years. No other significant facts were elicited in the history.

On general examination the boy appeared to be several years younger than his declared age. The distribution of body hair, the voice, and other secondary sexual characteristics were of the masculine type. The penis was normal and erection was declared to take place. Palpation of the scrotum showed what at first seemed like three well-formed testicles in the left side, with none in the right. Undescended testicles could not be palpated but there was an indefinite elongated mass in the left inguinal canal. The three objects in the left half of the scrotum were freely movable, but not tender, and were connected to each other and to the contents of the inguinal canal by cord-like structures. A cord on the right side was felt for a short distance below the pubes, but ended in a mass of tissue so small as to be scarcely palpable. Rectal examination did not show evidence of intrapelvic testicles or other anomalies. A preoperative diagnosis was not made.

At operation an incision was made over the left inguinal canal as for hernia, and was prolonged downward to expose the scrotal contents. The three objects mentioned then appeared to be a complete set of female genitals, with very large ovaries and a small bicornate uterus supporting two small fallopian tubes about

the length of testicles or ovaries (about 3.8 cm.). The cervix was not evident as such, but the cord-like mass running up into the inguinal canal corresponded to the position of the cervix and vagina of the small inverted uterus upside down in the scrotal sac. The surgeon, believing the glandular structures to be ovaries, removed the entire mass. The patient was dismissed twelve days after operation, free from symptoms. The specimen was sent to the Cole Hospital Laboratory at Vellore for examination.

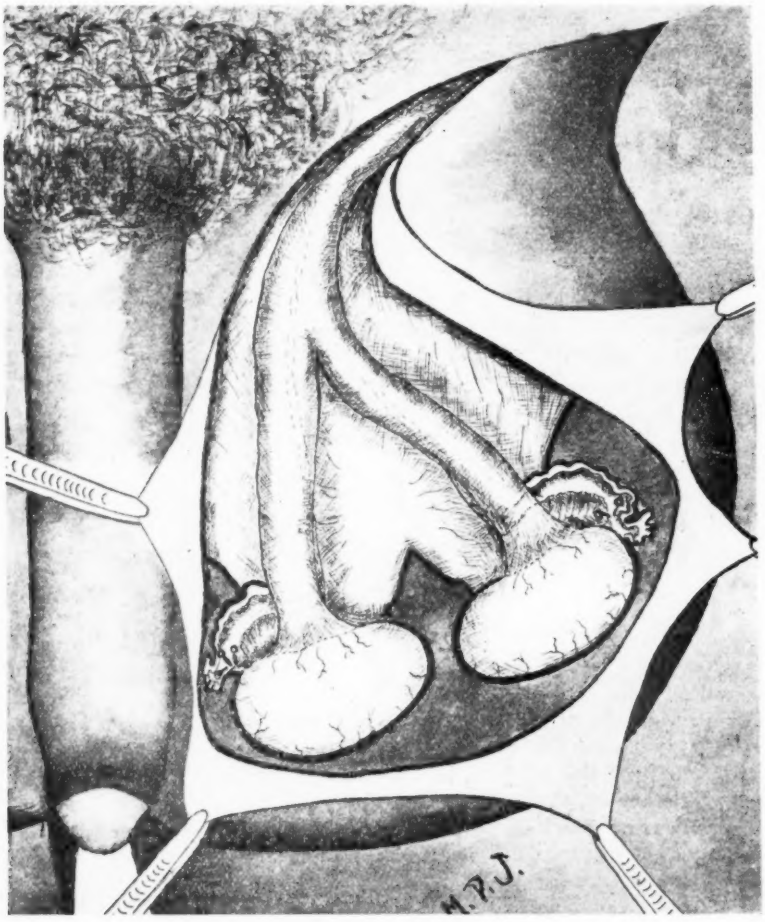

Fig. 1.—Left side of scrotum opened, showing dorsal surface of uterus and testes, also hydatids of Morgagni.

The uterus was covered with serous membrane resembling its usual peritoneal covering and this was reflected in one pair of folds suggesting broad ligaments and another pair of folds enclosing the little fallopian tubes which were about 3.5 cm. long and could be probed as far as the horns of the little bicornate uterus, but not into the fundus. The membrane was continuous from the surface of the fallopian tubes to its attachment to the longitudinal aspect of the glandular masses, lying parallel to the tubes. The bicornate uterus was found to contain only one common lower uterine segment. Running parallel with the cord-like mass leading up into the inguinal canal, were a pair of ducts containing a whitish secretion.

These could be probed for a distance of 10 cm. and when the overlying membrane was dissected away, they were found to run along the lateral aspects of the uterus but quite distinct from it. They terminated, under cover of the fold of membrane enclosing the fallopian tubes, in a linear attachment to the glandular structures and at this attachment the small vasa deferentia of an epididymis could be seen.

Microscopic sections of glandular structures proved that they were not ovaries

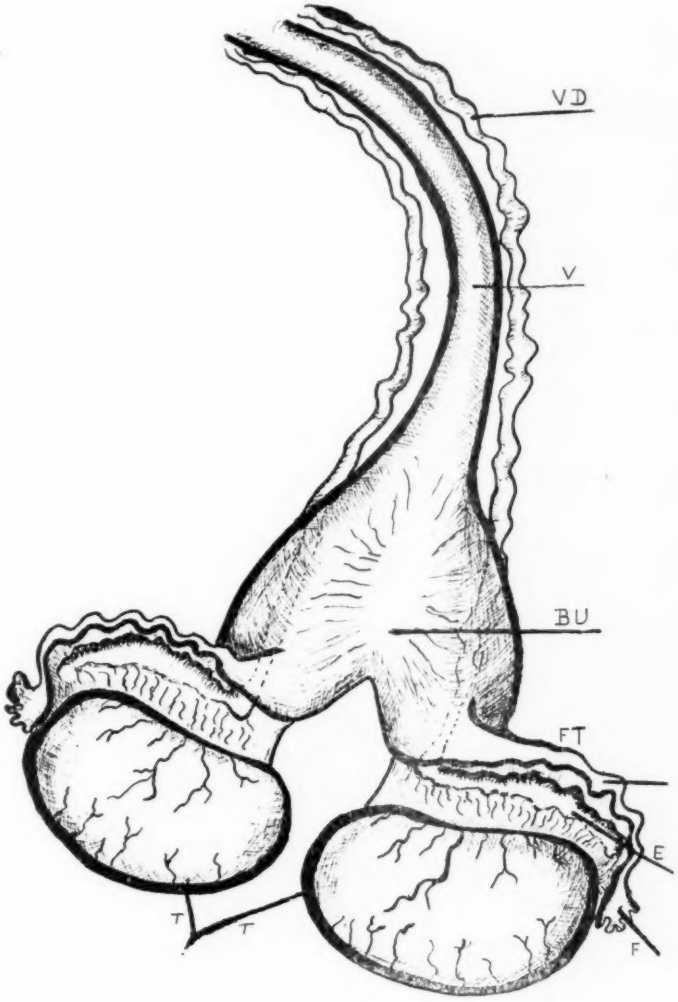

Fig. 2.—Ventral aspect of excised specimen. *VD*, vas deferens; *V*, vagina, solid cord; *BU*, bicornuate uterus; *FT*, fallopian tube; *E*, epididymis; *F*, fimbria; *TT*, testes.

but testicles. The ovoid bodies were about 3.8 cm. long, round, instead of flattened and firm and yellowish. Fine blood vessels were distributed over their surfaces radiating from the region of attachment to the epididymis.

This anomaly represents simultaneous development of uterus, tubes, vas, epididymis, and testes, with normal appearing external male genitals and with no testicle on the right side, the entire mass being in the left scrotal sac.

Postoperative Notes.—After the operation, performed on July 20, 1927, the convalescence in the hospital was uneventful. On March 17, 1928, eight months after operation, the boy was called back from his village for a follow-up clinic, and found to be in excellent health, free from pain. Examination of the genitalia showed a normal penis, except for severe scabies; an empty scrotal sac with a well-healed postoperative scar on the left, and no hernia. The pubic hair was scanty, but no more so than before operation, and still of the male type of distribution. There was also no change in the hair distribution of the rest of the body. There were no observable postoperative changes in the breasts, habitus, or voice of the boy, and he seemed quite bright and active.

A REPORT OF TWO CASES OF PNEUMOCOCCIC PERITONITIS FOLLOWING NORMAL LABOR

By J. R. McCord, M.D., Atlanta, Georgia

(From the Department of Obstetrics, Emory University School of Medicine)

IN THE *Journal of Obstetrics and Gynecology of the British Empire*, Vol. xxxiv, No. 4, Harold F. Seymour reported "A Case of Pneumococcal Peritonitis During the Puerperium, With Recovery." He stated that he was able to find only one other case reported in the literature. His contribution leads me to report the following two cases.

Case 1.—A negress, E. C., primipara, aged eighteen, was admitted to the obstetric ward at 7:10 P. M., April 25, 1925, in active labor. Her temperature, pulse, and respiration were normal; a Wassermann test was negative. Her previous history was negative. Labor was completed fifty-six minutes after admission to the hospital. During labor no vaginal examinations were made, and she had only two rectal examinations. She was delivered of a seven pound, three ounce baby, no perineal tears resulting. A small amount of ether was given during the passage of the head over the perineum; this consumed from four to five minutes. The placenta was delivered by early expression four minutes after the birth of the baby, the patient having had an injection of one c.c. of pituitrin. She was returned to the ward with normal temperature, pulse, and respiration.

On the third day postpartum, April 29, the patient complained of pain in her abdomen. Her temperature at this time was 103.2°, pulse 128, and respiration 30. This was the first elevation of temperature, pulse, and respiration she had. At this time a blood count showed 19,000 leucocytes, 85 per cent polymorphonuclears, 12 per cent small lymphocytes, and 3 per cent large lymphocytes.

On May 1 her temperature, pulse, and respiration had all increased, and her temperature, thereafter, was very irregular. She had no nausea or vomiting, no sore throat, no breast trouble, nor were there any bladder symptoms. There was slight tenderness over both kidneys. Her abdomen was slightly distended, and there was some tenderness and rigidity over the entire abdomen but more marked below the umbilicus. There was no dullness in the flanks; her uterus was very tender. Just before the first elevation of temperature she had a slight chill. The findings were very suggestive of an early peritonitis. On May 2, a blood culture was taken.

Under novocaine anesthesia the abdomen was opened, and a large amount of greenish-yellow pus was expelled. Recent adhesions were all over the abdomen.

The omentum was well down in the abdomen and was adherent to the intestines and uterus. A tube drain was placed behind the uterus and a Penrose drain in each iliac fossa. A smear was made of the pus obtained. Death occurred at 9:45 P.M., May 3, 1925.

The necropsy was confined to the abdomen. Upon opening the abdomen a moderate amount of greenish yellow fluid escaped. A thick gelatinous fibropurplent exudate covered the peritoneum and intestines. The omentum was well down in the pelvis, completely covering the uterus and intestines. The spleen was considerably enlarged, an acute splenitis. The uterus reached two centimeters below the umbilicus; the surface was reddened and there were subserous hemorrhages. The endometrium was necrotic, and the cavity of the uterus was filled with a dark brown exudate. The cause of death was given as general peritonitis.

The blood culture was positive for pneumococci. The smear taken at the time of operation and the spear taken at necropsy were both positive for pneumococci.

CASE 2.—A negress, R. J., primipara, aged eighteen, was admitted to the obstetric ward at 8 A. M., May 22, 1925. At this time she was in active labor; her temperature, pulse, and respiration were normal, and her Wassermann reaction was negative. Her previous history was irrelevant. She was delivered of a living baby girl, weighing five pounds, eight and one-half ounces, no perineal tears resulting. Three rectal examinations were made during labor; she did not have a vaginal examination. No anesthetic was given. The placenta was delivered normally after the patient had an injection of one c.c. of pituitrin. She was returned to the ward with normal temperature, pulse, and respiration.

On May 23, just twelve hours later, she complained of pain in the abdomen and of being cold. At this time her temperature was 103.2°, pulse 108, and respiration 26. A blood count showed 16,500 leucocytes, 95 per cent polymorphonuclears, 4 per cent small lymphocytes, and 1 per cent large lymphocytes. A blood culture was made. The patient was in a semistuporous condition; her abdomen was slightly distended, with some tenderness over the entire abdomen but more marked over the lower quadrants. There was a slight dullness in the left flank and tympany elsewhere. A few moist râles were heard at the bases of the lungs. She died at 2:25 A.M., May 27, 1925.

The cause of death as reported from the necropsy was general peritonitis. The anatomic diagnosis was: (1) endocervicitis, (2) endometritis, (3) salpingo-oophoritis bilateral, (4) general peritonitis, (5) petechial hemorrhages in the lungs, (6) fibrinous pleuritis, right, (7) acute splenitis, (8) passive hyperemia and cloudy swelling of the liver and the kidneys. The blood culture was reported as pure pneumococci.

At about this time two or three other deaths, with the same general symptoms, but in which no positive blood cultures were obtained, occurred. On no case was a vaginal examination made. All labors were easy ones, with no perineal tears.

131 FORREST AVE., N. E.

A CASE OF OVARIAN PREGNANCY OF FIVE MONTHS' DEVELOPMENT

By G. Van Amber Brown, M.D., Detroit, Mich.

A PRIMARY ovarian pregnancy is the result of fecundation of the ovum while still within the graafian follicle. Examples of such a condition are sufficiently uncommon that all are worthy of being placed on record. The conditions which must be fulfilled in the specimen in question is to be regarded as one of proved primary ovarian gestation.

Ovarian pregnancy appears to have been first described by Mercerus in 1614. An important monograph on the subject was written by DeSanctis Maurice in 1862, and was translated into several languages. Although cases were reported from time to time, there was no evidence to distinguish them from tubal pregnancies.

Kower presented before a gynecologic society, a specimen of ovarian pregnancy, a summarized pathologic report of which was later published by Dr. Catherine Van Tussenbrock (Central-blatt für Gynäk., 1897). This is in fact the first positive case on record and was later (1899) thoroughly described and carefully studied anatomically by Dr. Van Tussenbrock. The complete description in detail of the Van Tussenbrock specimen proved beyond a doubt the real condition and served as a guide for further observations. Speigelberg, as far back as 1878, was the first to suggest certain factors of identification: (1) The tube of the affected side must be intact. (2) The fetal sac must occupy the position of the ovary; (3) it must be connected with the uterus by the uteroovarian ligament; (4) definite ovarian tissue should be found in the sac wall. These requirements were later considered insufficient, and numerous criteria have been set up by Heinecken, Williams, Werth, Norris, Caturani and Jacobson; that of Norris standing as the most complete. Can he doubt the primary development of the gestation in the ovary, because of finding of a decidual reaction in the corresponding tube? If with tubal pregnancy the opposite tube is apt to react, why cannot we obtain the same reaction in the tube connected with the pregnant ovary?

The absence of the fetus in many of the recorded cases in itself demonstrated the entire inapplicability of the criterion added by Jacobson (1908). Moreover, the histologic appearance of the ovarian tissue around certain portions of the blood-clot in the present, and also in some of the cases in the literature, would seem to suggest that it may be very difficult to find remnants of ovarian tissue at several points in a case of pregnancy which has advanced far. Hence, this criterion of Spiegelberg (1878) cannot be regarded as necessarily crucial. Whenever the implantation is developed at the outer, instead of at the inner, margin of the follicle, as in the case of Banks (1912) early destruction, even if not early rupture, of the overlying ovarian stroma and capsule would seem to be inevitable. Indeed, whenever the layer of ovarian stroma overlying the placenta is thin, very early death of the fetus would seem to be inevitable from defective nutrition alone. On the other hand, when placental development occurs in the region of the follicle directed toward the body of the ovary, great destruction of the ovarian stroma would seem to be unavoidable, even if something akin to normal decidual formation actually took

*Read before the Fortieth Annual Meeting of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, September, 16-20, 1927.

place. In the case of Engelking (1913), for example, not a trace of an ovary was found in an ovarian pregnancy which had become interstitial. Even without assuming the complete authenticity of this rather equivocal case, it would seem highly probable that the presence of ovarian tissue later in pregnancy is determined very largely by the location of the fertilized follicle within, or by the exact location of the implantation upon the ovary.

This short summary suffices to show that there is yet no consensus of opinion as to what constitutes an ovarian pregnancy. Although this fact finds its explanation partly in our lack of sufficient knowledge, it is due also to the meagerness of some of the reports. Besides, if complete disintegration and lysis of intraovarian conception can occur, then it must always remain a question of opinion in the future whether some of the cases so reported really were or were not true ovarian pregnancies. This must remain true no matter how thorough the microscopic examination, unless the clinical history or changes in the maternal organism can afford us crucial tests in such cases.

Anyone who reads far into the literature of ovarian pregnancies also must become aware of the fact that even very recently skepticism has been carried too far. Jacobson (1908), for example, placed the case of Kouwer-Van Tussenbrock (a case which finally convinced Bland-Sutton) and that of Webster (1904) in the doubtful class. Furthermore, Jacobson also insisted upon the presence of an embryo or fetus as absolutely essential. It must be emphasized, however, that even a liberal attitude on the part of a reviewer would not justify him in accepting all cases reported as genuine upon the basis of the reports themselves, for they, especially the older ones, often are too meager to enable one to form a reliable opinion. From evidence contained in literature, it is clear that further reports of single cases are not needed for the purpose of emphasizing the occurrence of ovarian pregnancy. Yet such reports nevertheless may help in the determination of the relative frequency of this novel and sinister condition, and also throw further light upon its genesis and the finer relations of the implantations, as well as upon other matters. Moreover, since the cases which are accompanied by a careful histologic examination and which for this reason alone are wholly unequivocal from an anatomic standpoint still are relatively few, the report of an additional scrutiny of the titles listed for the last decade reveals the fact that 5 cases of ovarian pregnancy were reported in 1908; 4 each in 1909 and 1910; 7 in 1911; 13 in 1912; 9 in 1913; 7 in 1914; 3 in 1915; 1 in 1916; 5 in 1917. This makes a total of 58 cases apparently reported within this decade. Lockyer (1917) as stated above accepted as authentic only 22 cases of those reported between 1910 and 1917, but his review is only a partial one. Even so, it shows that there is a decided increase in the number of cases which have been regarded as genuine from decade to decade. Williams (1910), as mentioned before, found only 13 positive cases up

to 1906; whereas, Norris found 19 positive cases in the single decade 1899 and 1909. That is, Norris found more positive cases reported in this decade than had been reported in all previous medical history up to 1906. This is surely a significant fact.

Schumann in his monograph on *Extrauterine Pregnancy* (1921) quotes Norris' collection of 19 positive cases from the literature up to 1909. From 1909 to 1917, Lockyer accepts 22 cases. A case reported by Meyer and Wynne in 1919 is accepted by Lockyer, bringing the total up to 42. A review of the literature from 1919 to 1926, by H. V. Vineberg, shows 17 cases reported in which he states that "all but three fulfilled the criteria of authentic cases of ovarian pregnancy, thus making a total of 14 cases for that period." On May 11, 1926, he reports his case which makes a total to that date of 57 authentic cases.

In 1926 there are five additional cases, four of which have been reported in the literature. Regarding these there has been no critical study published as to whether they are to be classed as doubtful or accepted as proved; the fifth for 1926 is my case which I herewith report.

Mrs. C. S., Mexican, housewife, age 32, well developed, fairly well nourished, married 17 years; had never been pregnant. Menses began at 17 years, always regular; 28 day type. Flow profuse, 6 days, no pain. Last period February 3, 1926. General health has been fairly good; no operations. Chief complaint, enlargement of abdomen of eight months' duration.

Patient was fairly well until February, 1926, when she developed a severe pain in the lower abdomen. For three months she was nauseated and vomited a great deal and had pain in the abdomen ever since. She did not menstruate from February until July. On July third, patient entered the hospital with the diagnosis of pregnancy. She had some vaginal bleeding, but it was not like a normal menstrual flow. She complained of considerable pain in her abdomen and vomited everything taken by mouth. There was marked tenderness over both iliac regions and her abdomen was tender throughout. The uterus was thought to be palpable up to one inch above the iliac crests. RBC 2,840,000. WBC 8600. Poly. 68. SL 18. LL 10. M 4. Urine negative for albumin and sugar. She remained in the hospital for seven days, during which time her temperature rose as high as 101°. X-ray examination revealed no evidence of pregnancy. When discharged from the hospital she was much improved; nausea and vomiting ceased. The abdominal tenderness and rigidity had disappeared. At present (October 13, 1926) she sleeps well and her appetite is good; constipation marked and there is frequent urination; abdominal pain is marked. Patient reentered the hospital on this date, complaining of abdominal soreness and a continued bloody vaginal discharge, having an offensive odor. The general condition of patient was quite good. Abdominal examination revealed a large tumor, regular in outline, centrally located, occupying nearly the whole abdominal cavity with margins of the abdomen above, below and laterally free from tumifaction. Oct. 14, 1926. RBC 4,890,000. WBC 7700. Urine SG 1013. Sugar negative, albumin trace. Microscopic, epithelium and pus cells with bacillus coli. Diagnosis, ovarian cyst.

Operation October 14, 1926. A median incision was made extending from the pubis to an inch above and to the left of the umbilicus. A large tumor was found

which on its anterior surface was, by mass adhesions, firmly attached to the anterior parietal peritoneum, on the inferior surface, also laterally it was firmly adherent to loops of intestine. On the superior surface it was adherent to the omentum. The entire mass was surrounded by dense adhesions. On freeing these the tumor was delivered and found to be attached by a long, quite narrow and thin pedicle to the left cornu of the uterus. This pedicle was unmistakably the uteroovarian ligament. Attached to the mass on the anterior inferior portion and about 5 cm. from the attachment of the pedicle of the tumor, the central portion of the left oviduct, which was intact, was attached to the tumor wall covering an area 0.5 by 1 cm. By this adhesion the tube was kinked. The tube was apparently somewhat lengthened, its fimbriae free, and distant from the tumor mass. The right tube was macroscopically normal in appearance, except that the blood vessels were engorged. The right ovary was not macroscopically pathologic; the uterus was boggy and retroflexed with the fundus low in the culdesac. The tumor mass was high in the abdomen, leaving considerable distance between the uterus and tumor. The tumor having been freed from the adherent structures, which was accomplished with great difficulty, the pedicle was ligated, severed, and the mass removed. The abdomen was closed in layers using No. 1 catgut chromic, throughout, except that clips were used for the skin.

Examination of the specimen after its removal showed what was apparently a large simple ovarian cyst, 24 cm. in diameter (fresh specimen), with a portion of the round ligament attached; also a small portion of the oviduct, which though quite normal in appearance was firmly attached to the cyst wall.

PATHOLOGIST'S REPORT

The specimen (formalin fixed) was a well rounded mass of tissue, 14 cm. in diameter with an external surface closely comparable to that of a thin cyst wall. Distributed over the peripheral surface were numerous small blood vessels. Upon one side was a folded portion of an oviduct with a diameter averaging 1 cm. At a distance of approximately 4.5 cm. from the oviduct was a small bit of firm tissue resembling the round ligament. Close examination of the peripheral surface of the sac suggests varying degrees of density of the wall. The bisected internal surfaces show contents consisting of a fetus 22 cm. long occiput—foot measurement. The attached umbilical cord was 19 cm. long; the fetus, a male of apparent normal development, but now showing early mumification changes. The cord attachment was peculiar because of firm fixation against a thinned-out portion of the sac wall, fully 3 cm. away from the placental mass. Vessels extend from the placental margin across to the attached surface of the cord, making the identification of membranous marginal union with the placenta proper. The cubical area of the space occupied by the fetus and that occupied by the placenta were approximately equal. The amniotic membrane was intact and lined the fetal partitional area. The placenta was extensively hemorrhagic. The hemorrhagic material was between the outside surface of the amniotic sac and the internal surface of the main sac wall, and exhibited some smoothly molded masses beneath the amnion projecting close against the fetus.

A large number of microscopic sections were taken from the placental portion, the sac wall and the umbilical cord attachment site. In all sections examined there was no formation of decidua. The inner surface of the sac wall exhibited a reaction of a typical chronic inflammatory type. The entire wall was closely compacted and quite generally atrophic. The cell nuclei showed marked irregularity of sizes in places having the appearance of laking. The assembling of the cells offered the same pattern of architecture found in ovarian stroma after its subjection to

marked pressure changes. In places definite well preserved areas of interlacing unit structures were plainly discerned. The better preserved portions of the wall had the staining characteristics of compact ovarian stroma. In one section cut from the oviduct wall, to which is attached part of the clotted blood, there were definitely well preserved muscle bundles. The oviduct was infected and imperfectly canalized. In all sections upon the inner surface of the sac wall could be seen attached placental tissue and clotted blood. The attachment therefore includes both ovarian and oviduct tissues. The placental tissues in all sections were necrotic. The greater part of the red blood cell clot showed complete hemolysis. The epithelium of the chorionic villi stained deeply with hematoxylin and in places showed calcium deposition. In one portion of the sac wall there was a large thrombosed vein.

Diagnosis: Ovarian and tubal pregnancy. The fetal newgrowth is primarily ovarian in genesis; the enclosing sac wall being chiefly ovarian structure. (James E. Davis, pathologist.)

SECOND PATHOLOGIST'S REPORT SUPPLEMENTING FIRST

A section across a tubular structure showed the typical arrangement of muscle in layers comparable to the arrangement found in the oviduct. The structure varied from normal in that there was no single lumen with mucosa thrown into folds or plicae; instead there was a scattering of multiple small tubules with smooth muscle bundles interspersed between them. The epithelial cells were columnar and arranged in a single layer. There was no change suggestive of a decidual reaction nor one comparable to a pseudodecidual reaction in the mucosa. The multiplicity of tubular spaces interspersed with muscle indicates an anomaly in development of the oviduct. There was some congestion of passive character and focal mononuclear cell infiltration. There was no ovarian tissue seen at the margin of the tube.

A section through the wall of the encapsulated pregnancy showed on its external surface tissues characteristic of ovarian cortex with fine millet seed type of stromal cell, the typical architectural arrangement, and a few hyalinized acellular fibrous bodies of corpora albuginea origin. No primordial or graafian follicles were present. The ovarian tissue showed great compaction and simple pressure atrophy, the zone occupied by ovarian cortex being but a millimeter or so in thickness. Beneath this cortex there was a loose spongy fibrous tissue zone of highly vascular character, the vessels being irregular, thin walled and flattened from internal pressure. Progressing inward there was a wide zone of tissue composed of hyalinized fibrous tissue infiltrated with some mononuclear cells and cells suggestive of trophoblastic origin, though markedly degenerated. The inner surface of the wall showed highly atrophied and degenerated chorionic tissue with fibrin and ghosts of chorionic villi in an almost formless layer.

Other sections taken through the wall at various sites showed no recognizable ovarian tissue. There must be kept in mind however that an implantation of a pregnancy in the broad ligament may cause a stretching out of ovarian tissue in the external surface of the tissues enveloping the pregnancy and the ovarian tissues would tend to be localized in one part of the wall.

This specimen represents an ovarian pregnancy because there is no reaction in the tubal mucosa ordinarily accompanying tubal pregnancy; because there is definite, well recognizable ovarian tissue greatly thinned down in the outer layer of the encapsulating wall. (A. L. Amolsch, pathologist.)*

*At the suggestion of Dr. Davis, a second pathologist was chosen by myself for an independent study and diagnosis of the specimen. Dr. Amolsch was the choice and his report supplements that of Davis.

In this case the ovary, distant from the uterus, unruptured and containing the fetus, the placenta attached within the ovarian structures, each tube intact and the fimbriae free makes the gross anatomic diagnosis perfectly easy. Acceptance of the microscopic diagnosis is also warranted as the evidence is in every way confirmatory, especially that ovarian tissue is found in numerous areas throughout the sac. Also, there is no fusion of the oviduct with the pregnancy mass, and in the mass chorionic tissue with ghosts of chorionic villi are demonstrable. Thus, the combined evidence of the gross and the microscopic fulfill all the requirements for a justifiable diagnosis of ovarian pregnancy.

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WOODWARD CLINIC.

Department of Maternal Welfare

CONDUCTED BY FRED L. ADAIR, M.D.

FIFTH ANNUAL CONFERENCE OF STATE DIRECTORS OF MATERNITY AND INFANCY WORK, WASHINGTON, D. C., APRIL 2-5, 1928

Abstracts of some of the papers read at the Fifth Annual Conference of State Directors of Maternity and Infancy Work, held at Washington, D. C., April 2-5, 1928, are herewith presented.

Maternity Care in Hospitals, Ralph W. Loberstine, New York City.

The average type of obstetric case can be conducted safely in the home under trying circumstances and amid none too clean surroundings, provided the medical attention and nursing care are good. Pregnancy and childbirth are frequently complicated, and first class care is difficult to obtain in the homes.

The abler obstetricians agree that abnormal pregnancies, first labors, and all abnormal labors would be best handled in hospitals. This requires a greater number of maternity beds and of trained obstetricians. Many cases complicated by toxemia or bleeding could be hospitalized and carried to a period of fetal viability.

There should be a certain amount of follow-up care in the home for hospital cases. This should be carried on by prenatal and postnatal clinics connected with the hospitals or by organizations closely affiliated with them.

Maternity hospital service should permit of emergency obstetric operation, on short notice, day or night. Rectal examination is preferable and yet is not harmless and allows more mistakes in diagnosis. Sterile gloves should be used.

There should be thorough preparation of the field of delivery and aseptic technic throughout. In a general hospital there should be no interchange of personnel or equipment between the maternity and other parts of the hospital. Infected cases should be segregated and if possible have separate equipment and personnel.

There is danger of infection for the babies from overcrowding and from attendants who harbor infections.

In rural communities one solution of the problem of better maternity care seems to be the building of more county hospitals. They should have proper equipment and personnel trained for maternity work.

Home Deliveries, James R. McCord, M.D., Atlanta, Georgia.

Whatever advance is made in the practice of obstetrics will be due probably to recent graduates in medicine who have had good training. If the basic principles of the science of obstetrics have been thoroughly mastered, the technical details of the delivery will become of minor importance, whether the delivery is at home or in a hospital. Operative work should be hospitalized; but knowledge of the mechanics of labor is as important for normal as for abnormal cases. The general surgeon's lack of such knowledge may be responsible to some extent for the great number of cesarean operations.

If medical schools have weak obstetric departments and cannot give their students generous practical work under careful supervision, their graduates cannot be expected to practice obstetrics carefully. If the graduates know more about obstetrics, they will be eager to make it their specialty. Putting obstetrics on a higher plane is the first consideration and is the direct responsibility of the medical schools. The physician and the laity both must be taught the dignity and complexity of the subject.

In Emory University the work in obstetrics begins with the second semester of the second year. In the third year practical instruction on these subjects is given in the prenatal clinic under the direction of practicing obstetricians. In the fourth year deliveries and ward walks are added to prenatal work and the two-hour lecture and quiz course. Groups of four students live in the hospital a total of about 30 days. The student on active duty makes examinations when a case is admitted, filling out a detailed record. He is not allowed to leave the ward while a case is in labor, and 30 minute observations are charted. He delivers all the normal cases, his assistant observing and acting as anesthetist. Every case of labor, day or night, is witnessed by a graduate intern who also charts a brief summary. No vaginal examination may be made or pituitrin given unless the resident physician has seen the case and given his consent. The examination is made under supervision after the student has been instructed as to the proper method. The student also makes rounds with the resident obstetrician, charting his observations. The assisting student does the laboratory work of the ward. These four students work in the prenatal clinic, reviewing by actual work the diagnosis of pregnancy, position, and presentation, learning more as to pelvic contraction and the toxemias of pregnancy, and assisting in the prenatal syphilitic clinic.

In 15 years no student has failed in senior obstetrics. In the past year 1,180 women were delivered, 869 of whom attended the prenatal clinic. The operative incidence was 0.4 per cent, the mortality 0.8 per cent. In the past six years only 10 cesarean operations have been performed for some 6,000 to 7,000 deliveries. The mortality, morbidity, sepsis, eclampsia, positive Wassermanns, and stillbirths are decreasing.

Training the Public-Health Nurse for Rural Maternity Work, Miss Hazel Corbin, New York City.

Schools of nursing teach practically nothing about care and supervision during pregnancy, though the better schools are attempting to remedy this by instruction through prenatal and postnatal clinics.

The nurse's duties, though differing with the medical and nursing facilities available in different communities, may include:

(1) The mother's hygiene, nutrition, exercise and rest, and their adjustment to the family routine.

(2) Preparation for the baby; clothes, bed, toilet supplies, and care of toilet supplies.

(3) Care of the baby; bath, exercise, food, rest, adjustment of his daily routine to that of the family.

(4) Observation of the mother; ascertaining discomforts and symptoms needing attention, making urinalyses; taking blood pressure.

(5) Keeping the physician or hospital informed by sending detailed report of each visit with findings and advice given.

(6) Helping the physician at delivery and giving care during the postpartum period.

The Maternity Center Association provides about three months' training in maternity nursing, attempting to give as many student nurses as possible an understanding of the development of prenatal work in relation to public health work as a whole and as one phase of preventive medicine; a realization of the nature and value of adequate maternity care and of the way to give it, and an intelligent idea of the Maternity Center Association and its relation to other organizations in the community.

Though complete maternity care can be given in rural as well as metropolitan districts, the city service permits more varied experience in a given time, costs less per patient, and probably allows planning for more fruitful conferences and lectures.

Rural Hospitals or Maternities of Canada, Mrs. Jean T. Dillon, West Virginia.

As a means of keeping doctors in rural districts, the Union Hospital Act, passed eight years ago by the legislative assembly of Saskatchewan, provided for the formation of union hospital districts. The municipalities and townships in each district appoint a board of directors, and upon vote of the resident taxpayers in the district bonds are issued and a small hospital is built. It is equipped, maintained, and managed by the resident taxpayers through their representatives on the board of directors. The union hospitals may not be established where there are physicians. The directors of every hospital that has three or more practicing physicians residing within a radius of 2 miles appoint an attending medical, surgical and obstetrical staff. A hospital having 75 beds must have at least one resident intern. One bed is allowed for every 300 persons in the population, one-tenth of the accommodation to be for maternity cases, one-tenth for tuberculous patients. The hospital must comply with the "Regulations Governing Hospitals" to receive the government grant of 50 cents per patient per day.

About eight years ago the Canadian Red Cross Society organized the Red Cross Outpost Service to meet the need for nursing care in new districts opening up for immigration. The community furnishes the building, and the Red Cross equips it and for the first few months carries all financial responsibility. Then by previous agreement a gradual refund is begun. It is the policy of the Red Cross to make each outpost hospital a community center for health education. If the hospital finally is adopted as a municipal institution, the Red Cross makes a gift of the equipment. Patients who are able, pay $3 a day; those who cannot pay are cared for free of charge. These institutions, like the union hospitals, receive 50 cents per patient per day from the provincial government.

Causes and Prevention of Neonatal Mortality from the Pediatrician's Point of View, Dr. Julius H. Hess, Chicago, Illinois.

The need of understanding more clearly the etiologic factors of premature birth and the possibilities for their control has been pointed out. Conserving the life and health of the pregnant women and educating mothers of newborn infants in the essentials of child hygiene should be only the beginning of a campaign to lower neonatal mortality. The deaths of children under 1 year of age reported in Chicago declined from 66.6 per 1,000 births in 1926 to 62.75 in 1927.

Prenatal conferences are held in 17 infant-welfare stations in Chicago. Pregnant women not under a physician's care are encouraged to attend; midwives are encouraged to send their cases for examination, supervision, and advice. Urinalyses, taking of blood pressure, and Wassermann tests are a matter of routine; and

internal and external examinations and measurements are made at the first visit. If the women have not made arrangements for delivery they are advised to have a physician. If they cannot afford this, arrangements for their care are made in hospitals or for delivery at home under the care of an out-patient lying-in service. This prenatal work develops slowly; only about 1,000 new cases per year have been registered at the conferences in the three years of their existence, although Chicago has some 60,000 births annually.

For postnatal contacts the city is divided into 168 field districts in each of which a Department of health nurse is assigned to call on the mothers and babies as soon as birth reports are received. On this call the nurse emphasizes the advantages of breast feeding, advises the mother if she has difficulty in this regard, and points out the importance of regular medical supervision of the baby. This service is not rendered if the mother has a nurse or other attendant capable of rendering such service or if the family physician has indicated on his birth report that calls from the health department nurse are not desired.

Premature and congenitally diseased infants are cared for at a permanent station established in Sarah Morris Hospital in 1923. By April 1, 1928, this station had cared for 460 cases. Including those who died during the first 24 hours in the station, 62.2 per cent of the infants received before 1927 lived. 79.2 per cent of those received in 1927 lived, and 79.2 per cent of those received in 1928 to April 1 are alive. This station receives only 27.4 per cent of its cases from the hospital in which it is established.

Training Personnel for County Health Departments, Dr. Felix J. Underwood, Jackson, Mississippi.

Until recently, training and experience in public health work could be obtained only in apprenticeship to some self-made health officer, as only two or three medical schools have offered a program in preventive medicine and public health. For five or six years, however, the International Health Division of the Rockefeller Foundation has assisted the Alabama State Department of Health in maintaining a training station in Covington County, Alabama (now taken over by the State Board of Health). The consequent supply of trained physicians, nurses, and inspectors has made it possible for the Alabama board of health to establish new full-time county health departments, their advantages already being accessible to more than half the entire population. For the past 3 years no county directors, nurses, nor inspectors have been appointed who had not a course of practical training for their respective duties, and this will apply henceforth to all personnel.

More recently the Rockefeller Foundation has cooperated similarly with the State Health Departments of Ohio and of Mississippi, establishing training stations in Ohio in February, 1927, and in Mississippi in July, 1927, the latter being an intensive course due to the emergency of the Mississipp River flood in May, June and July, 1927. Mississippi now has an abundance of good material for health workers for more counties and will eventually, like Alabama, take over the training of its own personnel.

Reduction of Infant Mortality Due to Respiratory Diseases, Dr. Howard Childs Carpenter, Philadelphia, Pennsylvania.

Respiratory diseases as a group are second only to the natal and prenatal group of diseases as a cause of infant mortality, and their rate has risen 3.6 per cent in the period 1922-1926. The deaths reported from the four diseases in this group probably should all be ascribed to pneumonia. Classification on an etiologic basis,

as, for example, influenza-bacillus pneumonia, pneumococcus Type I, II, III, IV pneumonia, or streptococcus pneumonia, would be more helpful for prevention and treatment.

It is regrettable that public health officials have not sufficiently stressed the transmissibility of pneumonia. Isolation is advisable not only to protect the other members of the household but also to prevent them from becoming carriers and thus spreading the disease.

Hemolytic streptococci, which are the most frequent and important bacteria producing infection in the respiratory tract of infants, are found more frequently in the throats of children who have tonsils than in those whose tonsils have been removed.

A first item of education in prevention of respiratory diseases is the danger of too hot and too dry air in the home. A temperature of 65° F. with a humidity of 60 per cent will give fair safety from respiratory diseases, whereas a temperature of 72° with a relative humidity of 25 per cent will seem less warm and comfortable and will have a bad effect on the mucous membranes. The second most important item is the danger of overclothing the infant indoors—a practice especially common among the poor.

The occurrence in newborn infants of pneumonia—often incorrectly diagnosed as atelectasis—is an important reason for protecting them from sudden lowering of their temperatures. The delivery room should be warm and the infant should not be taken out of it nor bathed for at least four hours (or a longer period if the temperature is not yet normal). A suction apparatus should be at hand to remove secretions from the throat (instead of the common method of wiping out with a finger). Nurses having respiratory affections should not care for the newborn.

Reduction of Maternal and Infant Mortality in Rural Districts

Reduction of maternal and infant mortality in rural districts, as shown by comparison of the rates during cooperation under the maternity and infancy act (1922-1926) with those for a comparable period immediately preceding cooperation (excluding 1918, when the influenza epidemic may have influenced the rate) was discussed by 11 representatives from states which have been in the United States birth-registration area long enough for comparable figures to be available from the United States Bureau of the Census; which also have cooperated from the beginning or nearly the beginning of operation of the act; and in which the greatest reductions in rural maternal and infant mortality appear to have taken place.

Reduction of Rural Maternal Mortality.—Dr. T. B. Beatty, State Health Commissioner of Utah, discussed the reduction of 35.9 per cent in Utah; Dr. J. H. Mason Knox, Jr., director of the Maryland Bureau of Child Hygiene, the reduction of 26.1 per cent in Maryland; Dr. Lillian R. Smith, director of the Michigan Bureau of Child Hygiene and Public Health Nursing; the reduction of 24.9 per cent in Michigan; Dr. Ada E. Schweitzer, director of the Indiana Division of Infant and Child Hygiene, the reduction of 23.9 per cent in Indiana; Dr. E. C. Hartley, director of the Minnesota Division of Child Hygiene, the reduction of 21 per cent in Minnesota; Dr. J. A. Frank, acting director of the Ohio Division of Child Hygiene, the reduction of 19.9 per cent in Ohio; Dr. Mary Riggs Noble, director of the Preschool Division of the Pennsylvania Bureau of Child Health, the reduction of 16.6 per cent in Pennsylvania; Dr. Emily Gardiner, assistant director of the Virginia Bureau of Child Welfare, the reduction of 10.9 per cent in Virginia; Dr. Elizabeth M. Gardiner, director of the maternity, infancy, and child hygiene in

New York (whose cooperation began in May, 1923) discussed the reduction of 20.5 per cent which has taken place within New York's period of cooperation. All the speakers believed that the educational work done for improvement of prenatal and confinement care had been an important factor in the reduction of maternal mortality. Better obstetrics due to better training of physicians and the giving of more adequate prenatal care by physicians were also emphasized. Assistance from cooperating organizations and committees of lay persons that aided in establishing contacts was mentioned and the supervision and instruction of midwives in States having a considerable number of midwives. Other reasons suggested were increased hospitalization of maternity cases and extension of good highways (as lessening the inaccessibility of physicians and hospitals and facilitating the distribution of food in good condition).

Reduction in Rural Infant Mortality.—Doctor Noble discussed the reduction of 14.1 in Pennsylvania, Doctor Knox that of 13.3 per cent in Maryland, Doctor Schweitzer that of 12.6 per cent in Indiana, Doctor Smith that of 12.5 in Michigan, and Doctor Frank that of 12.3 per cent in Ohio. Mrs. Mary D. Davis, director of the New Hampshire Division of Maternity, Infancy, and Child Hygiene, discussed the reduction of 9.2 per cent in New Hampshire; Miss Elspeth Bennett, nutritionist of the Kentucky Bureau of Maternal and Child Health, the reduction of 8.1 per cent in Kentucky; Dr. H. Y. Richards, director of the Utah Bureau of Child Hygiene, the reduction of 7.9 per cent in Utah. These speakers mentioned among the probable causes the general educational work done, prompt reaching of parents of infants whose births were registered, extension of public health nursing, improvement accomplished in general sanitation and clean milk supply, cooperation of organized women, and the distribution of informative literature.

Society Transactions

NEW YORK OBSTETRICAL SOCIETY

MEETING OF JANUARY 10, 1928

THE PRESIDENT, DR. WILLIAM P. HEALY, IN THE CHAIR

DR. W. T. DANNREUTHER reported a case of **Mesenteric Lipomatosis and Megacolon, With Muscular Atrophy of the Abdominal Wall.** (For original article see page 267.)

DR. E. W. HOLLADAY observed a similar case in Bellevue Hospital about three years ago, in which the omentum was almost six inches thick and it was impossible for the operator even to reach down into the pelvis.

DR. B. P. WATSON presented a paper entitled **An Outbreak of Puerperal Sepsis in New York City.** (For original article see page 157.)

DISCUSSION

DR. A. C. BECK said that since the original influenza epidemic some morbidity and an occasional fatality occurred in the early spring months at the Long Island College Hospital. The nose and throat of nurses and physicians were regarded as possible carriers. All the patients who show a fever, are isolated in another ward of the hospital.

Last year three deaths occurred at a time when upper respiratory infections were prevalent, which were assumed as possible hematogenous infections from this source.

DR. O. P. HUMPSTONE said that during the first four months of 1927, 591 patients were delivered at the Methodist Episcopal Hospital of Brooklyn with four maternal deaths due to blood stream infection. Of these patients, three were ward cases, three multiparae, three had rectal examinations, and only one had a single vaginal examination. The membranes were ruptured within four hours of delivery in all and none of the deliveries were operative. Hemolytic streptococcus was obtained from the blood of each one. The patients were removed to the isolation ward at the onset of symptoms, and although there were other patients there no new cases developed in the isolation ward. The babies of these mothers were not affected. In no other cases did he recover the hemolytic streptococcus and felt that these were individual isolated cases, that contact was no factor, that although the delivery may have played some part in the development of the sepsis, it was doubtful if the infection entered by way of the vagina. Many other cases were delivered during the same period by forceps, version, induction by bag, and cesarean section, but not one of these developed a puerperal infection. Thus he felt that he was justified in keeping the wards open and considering these deaths as due to causes over which they had no control. Dr. Humpstone believed that if they had not been using the mercurochrome preparation for delivery, they would have had

cases of virulent sepsis in their operative cases as well and would undoubtedly have had to close the wards as was done at the Sloane.

In contrast with the above cases which undoubtedly had no definite relation to each other or to a common carrier, four babies died in one nursery, with a virulent infection. These all started with inflamed throats, three developed multiple abscesses, two had meningitis, and in three a hemolytic streptococcus was obtained from blood culture. They did not come from adjacent cribs, and no new cases developed in the isolation ward among the babies who were there at the time the babies were transferred. A night nurse who was on duty during the period in which these babies took sick developed a streptococcus sore throat and after her removal from the nursery no more cases developed. The mothers of three of these babies had normal puerpuria and the fourth had a mild respiratory infection. He believed that the same bacteria took the life of these babies that caused the infection in the mothers that died; in the one case the nurse was undoubtedly the carrier and in the other the individual mothers.

DR. J. O. POLAK said that this illuminating and epoch-making study demonstrates the dangers of the eleven sources of infection, that is, the ten fingers and the nasopharynx, and it further demonstrates that these gentlemen, after all their study of the subject, know very little more about it. The most impressive points were the autopsy findings which showed that the spread of the infection was through the lymphatic channels and this is contrary to his experience. The cases autopsied at the Long Island College Hospital which died from the same condition, apparently from the same type of infection have shown the condition to be in the blood stream, originating as a thrombophlebitis and developing as a blood stream infection. It would seem that if these infections had been recognized as lymphatic primarily, that perhaps there might have been some value in drainage of the thoracic duct.

Another interesting point is the conclusion of Dr. Watson with regard to transfusion. Dr. Polak had been impressed with the fact that early and repeated transfusion has a definite influence in affecting a cure. Dr. Polak was undecided as to how the bacteria got into the vagina and blood stream even from carriers. Many times this has occurred where no examination has been made. But undoubtedly marked diminution in morbidity and mortality resulted since both mouth and nose were masked and he was convinced that this has a great deal to do with the favorable outcome of an obstetric case.

DR. R. E. STETSON said he was particularly interested in the application of transfusion, not only as a supportive, but as a curative measure. He had only this criticism, namely that the transfusion was used only as a supportive measure. For its curative effects it must be used often. The presence of the hemolytic streptococcus, above all organisms, produces the greatest hemolysis and consequently the greatest blood destruction, and one would think of transfusion in this particular infection as being a most logical mode of treatment, transfusion every forty-eight hours, and unless the patient has a very severe anemia, preferably exsanguination transfusion, taking off anywhere from two-thirds to the full amount of blood that you give, namely, removing 400 to 500 c.c. of blood and giving 500 or 600 c.c.

Dr. Stetson had treated between 40 and 50 cases of either postabortal or puerperal sepsis. The figures given in a preliminary report four years ago, where 14 cases were reported with nine recoveries and five deaths, remain about the same in this larger group of cases, about 68 per cent of recoveries. Many of those cases were late, and the measure employed early in the disease will, of course, give consequently better results.

DR. R. L. DICKINSON wanted to know if, as a means of prevention in all maternities, the throats of all attendants should be cultured once a week.

DR. G. H. RYDER asked how much of a safeguard a mask is. Suppose a person has a streptococcus in his nose and throat and then delivers a patient thoroughly and completely masked, how much danger is that patient under at the time?

DR. WATSON, in closing, spoke as follows:

"We have come to believe very firmly that the complete masking of nose and mouth is most important. It was not carried out in Sloane Hospital until November, 1926. As Dr. Meleney has pointed out the masking was not complete as the mask might or might not fully cover the nose. Since the epidemic, we have insisted on complete masking of both mouth and nose. The regulation is being carried out to the letter in the hospital now, not only during delivery, but in the first-stage room; every one in the first-stage room is fully masked, and every nurse doing a postpartum dressing is fully masked.

"Dr. Meleney will perhaps answer the question as to how much protection that mask gives. If the individual puts on the mask and then takes it off and puts it on the reverse way, it is, of course, a menace and not a protection.

"Isolation of patients has always been carried out in Sloane Hospital. Before the epidemic, whenever a patient developed a temperature, she was isolated in a special ward and kept under close observation. Isolation regulations were carried out in the wards before the epidemic began. The regulation has been more strictly enforced since then, if that is possible.

"I may say that it was a great comfort to hear that others in New York had had a somewhat similar experience to ours, because we in the Sloane Hospital passed through a time of great trial and tribulation.

"With regard to the treatment of the cases and as to what Dr. Stetson has said with respect to transfusion, I would say that I agree with him that transfusion was not tried out in a systematic way in those cases. As I stated in the paper, if it had been begun earlier and been given more frequently in all the cases, I am quite sure that a good showing would have been made for transfusion, but quite a number of patients recovered without it, and that is all I can say about it. I don't think our figures prove anything whatever in regard to any form of treatment. It so happened that we carried out a certain line of treatment and a certain number of recoveries took place. There is no question but that the organism in this particular epidemic was an extremely virulent one. Some of our patients, one of the first patients who died for instance, had a transfusion on the second day. She, nevertheless, died on the third day. Two had transfusions done, one on the second day and the other on the second and sixth day, while others had it on the fourth, the ninth, the fourteenth, the twenty-fourth days, etc.

"We have made it an absolute rule in the hospital that no nurse is admitted unless she brings from her school a certificate of a negative culture of the nose and throat for the hemolytic streptococcus, and we are making weekly cultures of all the staff for the hemolytic streptococcus. So far this winter not a single streptococcus carrier has been found, which is very remarkable, when we compare with that the figures which Dr. Meleny gave us for last year.

"I am in agreement with Dr. Humpstone that we have not proved whether or not the first point of entry of the organism is by way of the vagina. All we can say is that the vagina was the only place where the organism was found other than in the nose and throat of carriers."

DR. MELENEY admitted the truth of the remarks of Dr. Humpstone and Dr. Polak that we have not added greatly to the knowledge of the genesis of puerperal

fever epidemics. In order to find out anything about an epidemic of this kind in its preepidemic stage, it is necessary to have in the hospital an organization which could set the stage in anticipation of an epidemic. Of course, that might be done in many hospitals and an epidemic occur where no trap was set, but at the same time something of this nature should be done in every hospital. The purpose of these suggestions is to institute measures to prevent carriers from coming into the hospital and to discover carriers who may have picked up organisms while on service in the hospital. The culturing of the staff could be done every week. Those with positive cultures could be kept away from the parturient woman just before, during, and just after labor. All that we can do under the circumstances is to minimize the opportunity of the streptococcus from coming in contact with the vulnerable uterine tissues. Unquestionably there is a seasonal variation in the incidence of the streptococcus in the nasopharynx. The incidence of the streptococcus in the surgical operating personnel of the Presbyterian Hospital was studied over a period of a year, and it was found that the incidence ran up to 25 or 30 per cent in the late winter and spring months. April and May were the two highest months. There is a gradual increase from the beginning of January until the latter part of the spring. When there are carriers about, there is a wider distribution of the organisms. If these organisms are virulent, they are going to manifest themselves in some form of an infection. Answering the question as to why the epidemic started at this particular time, one can only say that it was a combination of factors of which the chief was the occurrence of a particularly virulent organism carried by a number of persons in close contact with parturient women in a season of high streptococcus incidence. How this organism gets from the carriers into the patient is the essence of the whole thing.

Dr. Meleney continued as follows: "I cannot say anything more definite about this epidemic, but I can say very definitely about the case we had at the Presbyterian Hospital. We were having a series of very severe hemolytic streptococcus wound infections in clean cases. We made a careful bacteriologic survey and found that all of the things that ordinarily would be suspected were innocent. We found, however, a very high percentage of streptococcus carriers in the surgical personnel. We had just finished taking a complete culture of all the staff when one more case appeared in a simple hernia. On the operating team for that case there were three individuals who carried hemolytic streptococci. These persons were masking the mouth, but not the nose, and the instrument nurse was found to have the organism not only in the throat, but in the nose. Curiously enough, the patient himself had hemolytic streptococci in his nose and throat. This fact gave us the opportunity of demonstrating whether the patient had infected himself through his blood stream in the damaged tissues of the wound or whether the organism had been introduced from the outside. By serologic tests it was definitely proved that the organism from the nurse's nose and throat was biologically identical with the strain from the patient's wound and that his nose and throat strains were entirely different. The organism must have been discharged on the sterile field and then introduced into the wound. I would like very much to have the opportunity of testing out in any case of puerperal fever two strains of hemolytic streptococci, one from the nose and throat of the patient and the other from the vagina to see if the strains are identical. I feel quite certain that in this series of cases the patients did not have the organisms in their nose and throat, at least in a quantity sufficient to be obtained by the ordinary nose and throat cultures.

"It may be that we have emphasized too much the operative period and not paid enough attention to the postpartum course. Even after the epidemic was in full swing I felt confident from observations made in the hospital that the nurses taking

care of postpartum cases were not completely masking the nose and mouth all of the time. I tested out various masks and found that a four-ply mask of fine meshed gauze prevents organisms from being blown or sneezed or coughed through it. If a nurse is wearing a mask all day long, unquestionably she must blow her nose and take it off from time to time. Dochez found from experiments carried on in the Army that masks were not effective if worn all day. I did not stress the point, but I believe that the staff should rigidly mask not only before and during but also the first two or three days postpartum when the uterus has not yet built up its cellular resistance against the invasion of organisms. With regard to the use of vaccine in the treatment of this disease, it seems to me to be irrational, particularly in the acute stage. It would seem to be adding fuel to the flames. In vaccinating rabbits with these dead organisms to produce agglutinating serum, we found that it was difficult to get protection against even small doses of living organisms. This suggests that serum therapy would likewise be of little use."

NEW YORK OBSTETRICAL SOCIETY

MEETING OF FEBRUARY 14, 1928

DR. W. S. SMITH reported **A Case of Pyosalpinx Caused by Oxyuris Vermicularis Complicated by Torsion of the Oviduct.** (See page 205.)

DISCUSSION

DR. WILLIAM P. HEALY asked whether Dr. Smith had any theory as to how the worms got in.

DR. SMITH presumed that she may have had pin-worms which migrated from the anus up through the vagina, thence up through the cervix and lodged in the uterus and tubes. The process was one of very long duration on account of the density of the adhesions and that it probably caused her no trouble until the twist tightened up and gave her acute pain.

DR. RALPH A. HURD reported a case of **Successful Laparotomy for Puerperal Pyosalpinx.**

The patient was a young primipara whose pregnancy was apparently normal until about three weeks before the estimated date of confinement. At this time she began to show evidence of a toxemia which was characterized chiefly by edema of the face and extremities but also by albuminuria and a moderate elevation of blood pressure. These symptoms, mild at first, showed a distinct tendency to rapid progress for the worst, and it was decided to induce labor about at term. She was accordingly admitted to the hospital and induction attempted by the bag method which was unsuccessful. A second bagging, combined with rupture of the membranes and administration of small divided doses of pituitary extract, was performed forty-eight hours later. Labor followed but progressed very slowly with resulting extreme fatigue. After about thirty hours of difficult intermittent and relatively ineffectual labor, delivery of a living 8½-pound baby was successfully effected by medium forceps. She was examined vaginally only twice before delivery. There was a fairly deep unilateral laceration of the cervix and a median episiotomy was done, both of which were immediately repaired with interrupted catgut sutures.

On the third day postpartum the patient developed a severe chill with a rise

in temperature to nearly 105° F. It was accompanied by signs of pulmonary involvement and a diagnosis of bronchopneumonia was made. Gradual improvement in the chest took place and the temperature receded by lysis to reach nearly normal on the 13th day postpartum. The patient was in bad condition and began to complain of lower abdominal distress, which gradually became localized in the right lower quadrant and gave unmistakable evidence of an adnexal or possibly an appendix lesion. Two weeks had now elapsed since delivery and the patient was in a very serious condition. Bimanual examination revealed a tender mass to the right of the uterus. As the woman was becoming rapidly worse it was decided to remove the focus of infection.

Under gas anesthesia a posterior colpotomy was attempted but quickly abandoned because of the height and resulting inaccessibility of the lesion. The peritoneal cavity was entered through a low right rectus incision. Inspection showed normal ovaries, normal left tube, normal appendix and an apparently normal involuting uterus, although the serosa of all these organs was distinctly injected and devoid of the normal sheen of healthy peritoneum. The right tube was converted into a large spindle-shaped tumor measuring about 15 cm. in length and 5 cm. at its thickest portion. The fimbriated end was almost totally occluded but allowed the exit of minute quantities of a light creamy pus, from which was cultured the

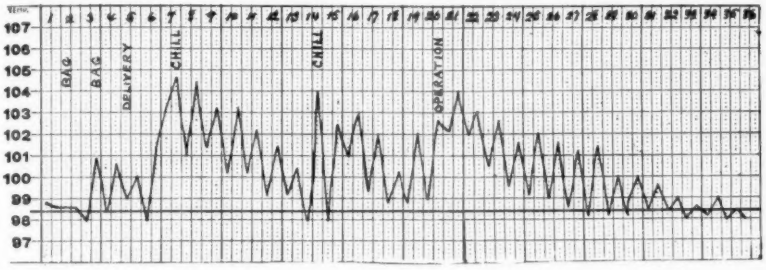

Fig. 1.

Staphylococcus aureus. The tube was rapidly excised and the abdomen closed after placing a cigarette drain down to the operative field and another deep into the posterior culdesac. The patient experienced a stormy postoperative period but by the fifth or sixth day began to show signs of definite improvement and continued to an uninterrupted recovery. She left the hospital with her baby after an illness of five weeks' duration and six months after confinement was in robust health with no demonstrable evidence of pelvic pathology.

It is rather surprising to find that the literature contains relatively few references to these cases, although they certainly must not be so extremely rare. Writing in 1895, Baldy relates an abdominal section for large pyosalpinx performed in 1887 one month postpartum upon a woman who was fast approaching death. He believes that this was the first time that successful laparotomy was deliberately and knowingly performed in the course of puerperal infection. He was then of the opinion that other so-called conservative methods in similar cases may well be left in the hands of the timid and that now and then abdominal section becomes not only advisable but essential.

Vineberg operated successfully by the abdominal route on several occasions. He formulated general principles to be employed in the treatment of postpartum tuboovarian infections and concluded that puerperal sepsis is a surgical disease and should, therefore, be treated by surgical methods. Byford published his views contemporaneously and reported four laparotomies done by himself. He felt that pus

should be evacuated through the vagina whenever possible but that one should not hesitate to perform abdominal section for the higher up and inaccessible lesions.

In 1910 Polak concluded that operative procedures should be avoided if possible and that they are not indicated unless there is demonstrable evidence of suppuration. In discussing the pathology of the various lesions of puerperal infection Williams asserts that in most instances the tubes are not involved and that when they are the lesions are secondary to the peritoneal infection.

DISCUSSION

DR. I. C. RUBIN asked whether there was any lochiometra present, because some months ago in a woman at Mount Sinai who was five or six months pregnant, an operation was done for appendicitis. A bilateral suppurative salpingitis was discovered. Nothing was done to the tubes, the abdomen was closed, and the patient was turned over to the gynecologic service. It was a great question how that woman in the fifth month or so of pregnancy could have developed a bilateral pyosalpinx, and the nearest we came to explaining the process was that she apparently had a closure of the internal os of the cervix and lochiametra. Repeated uterine contractions, which were not only sensible to the patient, but were palpable to touch, undoubtedly expelled this purulent secretion through the patulous internal ostia of the tubes.

In the case Dr. Hurd describes, it seems in the first place, with the repeated bagging which was necessary for the toxemia and delivery, and, secondly, the suture of the cervix, that most likely a certain amount of edema in traumatized tissue probably caused a retention in the uterus, and the placenta being plastered on the one side, leaving the other side free, permitted the escape through the uterine ostium of the purulent uterine secretion, thus resulting in a unilateral pyosalpinx.

DR. WILLIAM P. HEALY was impressed by the acutely-ill condition of this patient previous to the laparotomy, and yet the limited extent of pathology that was found in the pelvis to account for this state and the promptness with which she responded to the removal of the tube. It is a very unusual pathologic finding as a complication of a puerperal infection, as practically always there is a thrombophlebitis and a much more extensive lesion of the cellulitis type, not a salpingitis and especially not unilateral.

It would seem that this must have been an infection in the tube that could only just have arisen within a few hours, practically before the operative procedure. It does not seem possible that it could have been there very many days. It did not behave like an ordinary staphylococcus infection; it behaved more like a gonorrheal infection in the fact that there was a large, free tube.

DR. HURD (closing) said in answer to Dr. Rubin's question, whether the internal os was closed and whether there was possibly a reflux of lochia into the tube on that side, that this patient seemed to have a moderate amount of lochia and the immediate suturing of the cervix did nothing to close up the canal.

DR. G. L. MOENCH presented a paper entitled **Some Points in Veterinary Practice of Interest to the Gynecologist.** (For original article see page 254.)

DISCUSSION

DR. ROBERT T. FRANK said that Dr. Moench had drawn attention to a very important thing. That this is being more and more realized can be seen from the

fact that in the new book on biology and pathology of women by Halban and Seitz, an entire volume is given over to the study of the sex life of domestic animals.

A fact of great interest is that dealing with the lessened fertility of premature offspring. Dr. Frank referred to two sisters, fairly prominent young women, who were both premature. Their mother was a premature child, too. They are married to nonrelated husbands. One sister had two pregnancies which ended with hydrocephalic children. The other one has borne offspring which were either born dead or died in the first few days following delivery. Their family histories have been gone into by all the prominent eugenic authorities and biologists, but no light has been thrown on them. He feels inclined to think that Dr. Moench has given us a little light in this matter.

DR. DAVID MARINE (by invitation) presented an address entitled **Sex Glands, Suprarenal Interrelationship.**

BROOKLYN GYNECOLOGICAL SOCIETY

STATED MEETING, NOVEMBER 4, 1927

DR. CHARLES A. GORDON presented the report of a case of **Osteogenesis Imperfecta Congenita.** (For original article see page 214.)

DISCUSSION

DR. ELIOT BISHOP reported a similar case in a thirty-two-year-old multipara, whose first labor was a forty-eight-hour stillbirth, in 1914. Her second, in 1916, was easy, with a normal child, now living and well. Dr. Bishop first saw her February 22, 1920. As she had profuse vaginal bleeding, a tentative diagnosis of placenta previa was made at her home, and she was packed and taken to the hospital, where, in the early morning, a vaginal examination was made, and an os admitting two fingers, but no placenta, was found.

A foot presenting was grasped and came away in his hand during very easy manipulation. Pituitrin was given and a tight binder applied, and a very fair imitation of labor ensued, and the bleeding stopped. In three hours, however, pains disappeared and bleeding began again, and a vaginal hysterotomy was done. A very friable fetus was extracted. The patient bled profusely and left the table in shock, but made a fair recovery.

An autopsy gave the following: The fetus, a female, weighed 750 grams, and was approximately 30 cm. long.

The top of the head, including the ears, was avulsed, through an oblique plane passing from the root of the nose to the suboccipital region, leaving the brain exposed and the eyes loose in their orbits. The left leg had been torn off at the knee joint and the right leg through the lower third of the femur. There was a transverse tear in the anterior abdominal wall below the left costal margin, opening the peritoneal cavity and exposing the liver.

The skin and subcutaneous tissue was everywhere edematous and like soggy, wet cardboard, but no evidence of maceration.

The fetus had a dwarfed appearance out of proportion to its apparent age, which was estimated to be seven months or thereabouts. The limbs and neck were

short, the thighs flexed and abducted. A thick layer of pale edematous subcutaneous fat covered the arms, legs, and shoulders.

The most remarkable feature was the complete absence of ossification in the calvarium, which consisted of a thin membraneous layer to which the scalp was closely adherent and this membrane was lined by dura mater. There was some diffuse hemorrhage under the scalp. The latter is covered with a growth of short hair.

The bones throughout the body showed delayed and imperfect ossification. The base of the skull was composed largely of cartilage with some scattered bone deposits in the occiput and sphenoid. The vertebrae were soft and cartilaginous with small ossific foci in the bodies. The sternum contained one area of ossification in the manubrium. The shafts of the long bones contained soft dark red bone tissue. The extremities and ribs could be bent and fractured readily. The pelvic girdle was deficient in ossification. The thoracic and abdominal viscera showed no gross abnormality.

Microscopically the changes were not as striking as the gross picture. Sections made from different parts of the osseous system showed tardy ossification. The bone trabeculae were small, narrow, and fragmented. Calcification was deficient and the osteoblasts were poorly formed. There was embryonic connective tissue where bone ought to be in the process of development. Otherwise, there was nothing unusual in the microscopic pathology.

Dr. Bishop saw this patient three times that spring and she seemed to be in good condition except that once she had had a very severe attack of pelvic pain lasting half an hour. He saw her again in the spring of 1921, as her periods were very scanty and tarry in color; on the fourth visit, on May 11, she feared pregnancy, though she had had a five-day period on April 8, and there had been no coitus since March 15; her husband had developed impotence from some unknown cause. On May 19, Dr. Bishop removed her right adnexa for an ovarian cystoma with hemorrhage. Since that time she has had amenorrhea, until this July when menses reappeared.

While it must be admitted that this is in itself an interesting case, the reason for reporting the case was the consideration of the possible etiologic factors for the osteogenesis imperfecta, impotence of the male, which we know is frequently accompanied by imperfect spermatozoa; and ovarian dysfunction, as evidenced by the amenorrhea, or pituitary dysfunction, as shown by the fleeting attempt at labor.

CHICAGO GYNECOLOGICAL SOCIETY

STATED MEETING, DECEMBER 16, 1927

Dr. C. D. Hauch reported a case of **Hematoma in the Sheath of the Rectus Abdominis Muscle Due to Spontaneous Rupture of a Vessel.**

In the fall of 1923 Doctor Culbertson reported two patients with hematoma occurring spontaneously in the sheath of the rectus abdominis muscle. His report was later incorporated in an article which appeared in the *Journal of the American Medical Association* of December 19, 1925.

The following history is that of a woman seventy-one years old, well nourished, and in good general health except for an occasional attack of epigastric distress, and tenderness diagnosed as biliary disease. On February 5, 1924, at four o'clock

in the morning while turning from one side to the other in bed, she felt a stabbing pain in the upper right abdomen. It was more severe and sudden than her previous stomach attacks, and was soon followed by nausea, vomiting, sweating, and partial collapse. Physical examination made about six o'clock that morning revealed a tender, hard mass extending from the gall bladder area slightly below the umbilical line, three inches in diameter with edges well demarcated. A sedative was given and the patient was moved to the hospital.

Although this was definitely an "acute abdomen," the very sudden onset, the atypical physical signs, and the lack of corroborative laboratory findings made one hesitate about immediate surgical intervention. On entering the hospital the blood pressure was 160/92, temperature 99.6°, respiration 22, and pulse rate 80. The urine contained a trace of albumin and a few pus cells. The blood picture showed 4,000,000 red cells, 11,000 leucocytes, 75 per cent hemoglobin, and a coagulation time of one and one-half minutes. On February 6 the symptoms had abated slightly. X-ray examination on that day added nothing except a misleading suggestion that a tumor mass was pressing upon the duodenum from behind. Pelvic examination revealed only induration and resistance extending into the right lower abdomen. On February 7 ecchymosis appeared in the skin about the umbilicus and on the right abdominal wall. The temperature reached 100° and the pulse 90. Vomiting had ceased, but nausea continued. The tumor mass had increased in size, but its edges were not so easily outlined. Two tentative diagnoses were suggested: first, ovarian cyst with twisted pedicle; second, rupture of blood vessel in the abdominal wall. The possibility of the former seemed to make laparotomy imperative.

On February 8, through a right rectus incision, a handful of blood clot was removed from the abdominal wall. The peritoneum was intact and was not opened. There was no active bleeding and no fresh blood. In the bed of the cavity containing the clotted blood was the distal portion of the deep epigastric artery dissected free from all surrounding tissues for a distance of twelve centimeters. Its anastomosis with the superior epigastric could not be demonstrated and had probably been destroyed. The artery was ligated and the free portion removed. The wound was closed without drainage. The patient made a good recovery and is in good health today.

In this particular case the vessel was thrombosed, the bleeding had stopped, and the tissues would probably have absorbed the clot. If the diagnosis in this type of lesion could be definitely decided upon, it is probable that surgical interference could be avoided in those showing no evidence of continued hemorrhage.

DISCUSSION

DR. CAREY CULBERTSON said that since he worked up the literature on this subject in his report of two cases, he found that there are two or three cases a year reported in the German, French, English, and American literature, so that this condition while not common is not so rare and it invariably brings in the points of differential diagnosis mentioned by Dr. Hauch.

DR. IRVING S. STEIN AND DR. M. L. LEVENTHAL presented a paper on **Laparotrachelotomy: An Analytic Report of Forty Consecutive Operations Without a Death.** (See page 229.)

DR. W. C. DANFORTH AND DR. R. M. GRIER presented a paper on **Five Years' Experience With Low Cervical Cesarean Section.** (See page 239.)

DISCUSSION

DR. J. B. DELEE said he was pleased that the various hospitals and most of the members were recognizing the value of the low or cervical cesarean section, to which he has given the name of laparotracheolotomy.

On theoretical grounds Dr. DeLee has the following objections to the transverse incision: In the first place, the danger of hemorrhage, which Dr. Stein says is minimal. He has had 5 cases, in 2 of which the hemorrhage was considerable from the base of the broad ligament. These operations were performed by experienced men. A surgeon in another hospital had a case of severe hemorrhage, requiring transfusion. Difficulties might arise in the subsequent labors. Physiologically, when the uterus contracts, it pulls away from the cervix in a longitudinal direction. There is a predisposition to abdominal hernia, admittedly greater with the vertical incision. The next objection is that in case an infection occurs, the pus is high up in the abdomen rather than low down near the external os where it can be readily reached, or easily find exit. When a women with a low cervical section becomes infected, it is not at all difficult to put the finger through the external os and force it through the stitches under the bladder and let out the pus. Furthermore, the pus very often takes its way out through that opening, whereas if the pus were high up under the bladder it would be more apt to cause a perimetritis or a thrombophlebitis. Another objection is that anatomically the blood vessels in the midline are smaller and less numerous. A practical objection that he found was the difficulty of making an accurate suture. The upper end of the lower segment is more likely to retract into the body of the uterus, particularly if the woman has been in labor long. The only case of embolism he had in his large series of low cervical sections was in a transverse incision. That patient recovered. The only advantage he could see in a transverse incision is that it is a little bit simpler and the delivery is a little easier.

Although experiments show that ethylene does not increase the clotting time of the blood nor the coagulation time, Dr. DeLee found that the amount of hemorrhage is often greater than it should be. However, ethylene is becoming more pure and perhaps the tendency to oozing is being eliminated. He uses it a great deal but had many cases in which he is convinced that ethylene caused extra bleeding.

At the Lying-in Hospital they give what is called "dosilene," a little alcohol, a few drops of ether and water, purely suggestive. No general anesthetic is used, if local anesthesia is possible, and he cannot recommend this plan too highly.

The low cervical cesarean section is considered more difficult than the classic. On the other hand, he has had quite a number of classic sections that caused a great deal of concern. Some of them bleed frightfully. Several times he has had to pack. There have been quite a number of cases of death from hemorrhage after the classic. The uterus relaxes or ruptures itself and the woman bleeds. Most of the cases of postoperative shock after classic cesarean section are due to that fact. There is not a case on record where a woman has bled after the cervical cesarean section. Once in a while a low cervical presents complications. If the man starting the practice of cervical cesarean section will limit his operation to the woman who has been in labor a long time, he will have no difficulty. The test of labor is a very uncertain matter. Some men will call a test of labor a few hours. Others will wait until the cervix is dilated and the pains are very strong for several hours. Sometimes a woman is considered to have had a sufficient test of labor when she starts out manifestly wrong; again he waits a long time. He cited a case in point: A woman pregnant for the second time was brought to the hospital. She had a high forceps with her first baby and had a justo minor pelvis. He thought he could get the seven pound baby through. A test of labor was given. She began having pains at 12 o'clock one day and labored until the next afternoon at 5. She had good pains and complete dilatation. He ruptured

the membranes and let her labor for two hours with very strong pains recurring every two minutes. At the end of that time the head was just as high. He then did a cervical cesarean under local anesthesia. She is now making a perfect recovery.

He has adopted the interrupted suture almost entirely for the low cervical. It takes fifteen to twenty minutes longer but seems to be better.

DR. CARL HENRY DAVIS said that during the past year some interesting anesthetic experiments had been done by Dr. Yates and Dr. Raine at Columbia Hospital, Milwaukee. They demonstrated that thirty minutes of anesthesia with ethylene oxygen or nitrous oxide oxygen, without an operation reduced the oxygen-carrying power of the blood to such a degree that it would take a transfusion of 500 c.c. of blood to bring it back to normal. After surgical operations it was found that it would be several days before the oxygen-carrying power was back to normal. He thought this was one of the strongest arguments ever advanced for local anesthesia.

Dr. Davis questioned whether or not it is advisable to do a cervical type operation in patients who have been delivered previously by the classic operation.

DR. D. A. HORNER called attention to a complication that occurred in two cases in which no packing was used. In both lochiometra developed which gave the patients considerable trouble. In no case that he knew of in which packing was used in the cervix has lochiometra developed because packing itself has a tendency to contract the uterus and if the cervix is not well dilated, it will have a tendency to increase the dilatation.

Infection is not produced, as a rule, by the introduction of the packing which is a prophylactic. There are several cases reported in which the packing was included in the suturing. In these cases difficulty was encountered in removing the packing. In one instance the packing was left in the uterus and was finally removed after the patient had been sent home several weeks after operation. No complications developed while she was at home, even though she removed the packing herself.

DR. J. P. GREENHILL said there were records of only eleven authentic cases of rupture of the lower uterine segment scar after the low cervical section in a series of over 25,000 cases. All of these ruptures occurred during labor—none during pregnancy.

At the Chicago Lying-in Hospital a follow-up in patients who have had more than one cervical cesarean section is being done. Thus far they have had 87 repeated cervical sections. Most of these were second operations but 8 patients have had a third and 1 patient a fourth cervical operation. There has not been a single case of rupture of the uterus. There have been 2 maternal deaths. An interesting point is that a number of these patients subsequently became pregnant and were delivered through the natural passages either spontaneously or by forceps.

Dr. Greenhill is now studying the scars removed at the second, third, and fourth low cervical operation. In nearly all cases the scar is not visible to the naked eye, but pieces of tissue excised from the area believed to be the site of the previous incision or incisions showed evidence of scar tissue microscopically in most instances. The scars were strong in practically all the cases. In 2 cases microscopic examination of the scars showed definite evidence of inflammation.

Not only can low cervical cesarean sections be performed successfully under local anesthesia but also Porro operations.

DR. C. S. BACON said that the papers read did not quite settle the doubts in his mind regarding the advisability of the low cervical cesarean section. In the first place, the indications for the operation were necessarily given rather briefly

and therefore perhaps not satisfactorily. The test of labor is so uncertain and unscientific that he did not think it counted very much. Then the comparison of the results of the low cervical section done by very competent experts with the results of cesarean section done by individuals in all parts of the country is not quite fair. It seemed to him that the decision is chiefly dependent on what Dr. DeLee spoke of, namely, the nature of the scar after low section. If the scar is better and stronger in low section, then that may be a very good reason for making it. It is a more difficult operation than the classic operation; it takes longer, and it is attended with a great deal more danger for the average operator. As far as infection is concerned, it is doubtful whether there is very much advantage in it.

DR. M. L. LEVENTHAL said that some of the patients reported in Dr. Stein's series are pregnant for the second time and they have had an opportunity to test the scar in those cases. In one case a patient delivered by a low cervical section with longitudinal scar came up for appendectomy one year later. The line of incision was examined, no evidence of any scar was found and there were no adhesions. In the other case the patient had a low cervical section a few years ago and was recently delivered vaginally, having been in labor fourteen hours. Upon removal of the adherent placenta, the lower segment was examined and no evidence of scar was found.

In this whole series no bladder injuries occurred even though the bladder was high during operation; and no more catheterizations were necessary than after pelvic delivery.

DR. J. L. BAER said that an analysis of the Lying-in Hospital statistics, presented by Dr. DeLee, gave a mortality rate of 1.1 per cent in low cervical cesarean section. An analysis of the Michael Reese Maternity in the two groups, classic section and low cervical section, all done by members of the obstetric staff of the hospital, trained obstetric surgeons, reveals that in the classical section there was a mortality of 5.5 per cent and in the low cervical 1.3 per cent, which to him was very conclusive evidence of the advantage of the low type of section. In this connection he took occasion to answer the comment published by Dr. DeLee in the *Year Book* of 1925, relative to the increased risks for confinement cases in the general hospital, of which Michael Reese represents one. The morbidity presented by Dr. Stein and the mortality of 1.3 per cent in the low cervical section as against 1.1 per cent for the Lying-in Hospital indicate that a maternity ward properly conducted in a general hospital compares favorably in mortality and morbidity with the maternity hospitals.

In connection with the disadvantages of the transverse incision that Dr. DeLee brought up, Dr. Baer stated that Munro Kerr does not use pituitrin. He maintains that by avoiding pituitrin he has a normally retracted upper half of the lower uterine segment and he, therefore, has no difficulty in suturing the transverse incision, the cut edges remaining equally thick.

Also on the question of rupture, they are using the transverse incision and for the past year have shaped the incision decidedly more semilunar than transverse with convexity pointing downward, so there is no risk of extensive lateral tearing. The scar is reinforced against vertical pull by the upturned ends and the flap affords even easier egress for the head.

DR. DANFORTH, in closing, said he was very thoroughly convinced after what he considers to be an adequate test of both types of operation that the low cervical is the better of the two, not only for a test of labor but also as an elective operation.

He agreed with Dr. DeLee that sometimes in dealing with the classic section the hemorrhage was difficult to manage. While he sometimes has hemorrhage in the low cervical that is troublesome, he has had no trouble in controlling it.

Dr. Danforth's first series represented 30 cases and since it was made up, 2 more cases occurred, making a total of 32, the same as Dr. Stein's series, so that the two papers presented represent a total of 64 cases. The time of rupture of the membranes is a little longer in Dr. Stein's series—17 against 12. There has been no essential difference in the recovery, in this type of operation and the old type, but there is considerable difference in the mortality. The mortality for the classical operation is around 7 per cent. The deaths are not entirely due to the operation. One patient had a cardiac dilatation; the autopsy showed no trouble in the abdomen. One patient died from pulmonary embolism. There were no deaths from sepsis.

He did not think that there was an attempt in this presentation to make a comparison of the results of cases done by men who are supposed to be experts in this field and the general operator. Dr. Bacon spoke of the lack of value of such comparison. That is not peculiar to cesarean section because the mortality in any operation is less in expert hands. Even in well run hospitals, such as Michael Reese or the Evanston, the mortality from the old operation does run higher than in the low operation. From that point of view as well as the point of view of morbidity he believed the low operation has the advantage over the old operation.

So far he has not done a second cervical section on a woman who has already had one. In answer to the question whether a woman who had had a classic section should not be delivered the second time by a classic section, he said that was a matter that had to be decided at the time. If the classic section scar was good and there were no adhesions below to give one trouble, he saw no reason why one should not do the second section by the cervical method.

Department of Reviews and Abstracts

CONDUCTED BY HUGO EHRENFEST, M.D., ASSOCIATE EDITOR

Selected Abstracts

Physiology and Pathology of the Breast

Pianese, F.: Researches Concerning the Origin of the Epidermal Pigment of the Nipple and Its Areola. Archivio di Ostetricia e Ginecologlia, 1925, xii, 73.

The majority of investigators believe the epidermal pigment is of dermal origin and is elaborated by the endothelial reticulum. Others assume that the pigment is of epidermal origin. There finally is a mixed theory, i.e., the pigment is sometimes of dermal and at other times of autochthonous origin.

In his researches, Pianese has been able to show that the pigment is distributed in the epithelial cells in the form of very small granules attached to the small threads of the protoplasmic network of the cells. This position of the pigment granules shows that the pigment is of protoplasmic origin and is either a transformation or a secretion, and that it originates in the epithelial cells.

In pregnancy the extension and increase of the pigment depend upon the peculiarities of general pigmentation in the individual.

E. L. FAUST.

Horn, J.: Hypermastia Axillaris. Acta Gynecologica Scandinavica, 1924, iii, Supplement.

Hypermastia signifies abnormally situated breast tissue. According to Horn, this condition is found in 3.5 per cent of Norwegian women and occurs three times as frequently as all other forms of ectopic breast tissue. In 13.5 per cent of the cases where hypermastia axillaris occurs, it is associated with breast tissue situated in other abnormal locations. The axillary type is distinguished from the other types by the very rare occurrence of nipples, areolas, or areolar musculature. In only 2 per cent of the cases is a rudiment of a nipple found. In structure, the axillary breasts resemble exactly that of the normal breast, but they are smaller and usually have no nipples. Axillary breasts undergo the same hypertrophy during pregnancy and the same regressive changes in the puerperium and like true breasts they can develop markedly at puberty and during the menstrual periods. At puberty and during menstruation and pregnancy they seldom produce symptoms but postpartum they are often painful. They have very little clinical significance.

J. P. GREENHILL.

Purvess and Hadley: Accessory Breasts in Labia Majora. British Journal of Surgery, 1927, xv, 279.

These authors report a case of bilateral situation of mammae in the labia majora of a thirty-four year old multipara. They quote the previously recorded cases of Blazio, Hartring, and Bell and deal interestingly with the subject from a com-

parative anatomic point of view. The breasts were removed and proved, histologically, to be made up of actively lacating mammary gland tissue.

M. SEELIG.

Dyroff, R.: The Physiology of Mammary Gland Secretion. Archiv fuer Gynäkologie, 1926, cxxix, 308.

The author determined the differences existing under the various conditions of pregnancy, puerperium, menopause, etc., between the intramammary temperature and the temperature of the blood. A small incision was made in the skin of the breast and a fine capillary thermometer inserted directly into the breast tissue. He found that the temperature within the breast increased as lactation becomes established. The difference between blood temperature and the intramammary temperature, exclusive of pregnancy and lactation, is 1.64°. There is a temperature rise in the breast when the milk comes in and the breast may have two degrees more temperature during this time than the blood shows. A failure to show this rise in breast tissue temperature may be of help in the differential diagnosis of hypogalactia. There is no direct relationship between the amount of breast secretion and the congestion and swelling of the breasts at the onset of lactation. There is no intramammary rise of temperature during nursing. There is, however, a marked temperature rise in the breast during the first ten to fifteen minutes following lactation which gradually recedes as the breasts refill. During the first half of pregnancy there is a slight difference in temperature between blood and breast (0.6°-0.9°). The figures approximate those found in the nonpregnant state. In late pregnancy there is practically no difference. The same holds true for the breast in abortion. Extrauterine pregnancy when unruptured shows the same differences as are found in early pregnancy and when ruptured resemble those found in abortion. Menstruation, tumors and adnexal disease produce no temperature changes in the breasts.

RALPH A. REIS.

Nakanishi, Y.: The Temperature of the Breast in Pregnancy and the Puerperium. The Japanese Journal of Obstetrics and Gynecology, 1927, x, 43.

It is a physiologic fact that glands in general show a rise in temperature during secretory function. The mammary glands exhibit the same rise in temperature. The following is a summary of observations made in 444 nongravid, gravid, and puerperal women.

The breast temperature of healthy nongravid women is far lower than that of the axilla. The breast temperature of gravid women is higher than that of the axilla.

No difference is recognized between primigravida and multipara with regard to the temperature of the breast which does not secrete colostrum. It rises as the pregnancy advances and in the puerperium it is higher than during pregnancy. It is higher immediately after lactation than before nursing, and in puerperal women who do not nurse it is absolutely the same as, or lower, than that of the axilla on the fifth to seventh days after labor. In puerperal women who have insufficient secretion it is often lower than that of the axilla. When improved by treatment, it is higher than that of the axilla.

The measurement of the temperature of the breast is a convenient way for determining the prognosis as to the secretion of the milk.

J. P. GREENHILL.

Polano: Investigation of Cyclic Changes in the Female Breast During the Period of Sexual Activity. Zeitschrift für Geburtshülfe und Gynäkologie, 1924, lxxxvii, 363.

The glandular tissue of the female breast, both in nulliparous and in parous patients, shows physiologically a cyclic proliferation in the premenstrual stage, which is followed at the beginning of menstruation and during the interval by a retrogressive phase. In contrast to the uterine mucosa, however, there are such great individual variations in the degree of proliferation and particularly in that of retrogression that the establishment of typical normal pictures, especially of the interval stage, is extremely difficult.

MARGARET SCHULZE.

Tso, Ernest: A Study of the Fat Lactose, and Protein Content of Chinese Women's Milk. The China Medical Journal, 1924, xxxviii, 626.

A study of 87 samples of Chinese women's milk shows that its percentage composition differs in no essential respects from the composition of human milk in other countries. The fat content varies considerably in individual samples. It is generally high in the strippings and low in the fore milk. It tends to be higher in mature and late milk than in colostrum milk. Samples obtained practically simultaneously from the right and left breasts may at times be quite unlike in their fat percentage. An investigation of the milk of those women who nurse their own babies and the milk of wet nurses shows that the former is usually richer in fat content than the latter.

The lactose is, relatively speaking, the most constant. The protein content varies to a wider extent than does lactose, and less so than fat.

F. J. SOUBA.

Grant, Agnes H.: The Nutritional Requirements of Nursing Mothers. The Effect of Lowering Both the Antirachitic Vitamine and Calcium in the Diet of the Mother Upon the Development of Rickets in the Young. American Journal of Hygiene, 1926, vi, 228.

The effects of lowering both the antirachitic vitamine and calcium of the mother's diet are seen in the retarded growth of the young when they are kept on a uniform low calcium, low vitamine diet, as well as in the change in the type of rickets which develops on this diet, and in the increasing readiness with which the disease attacks the spine.

The rate of growth of the young, after weaning, is correlated with their weight when they are weaned, and upon the length of the interval before they begin to develop signs of rickets. The weight curves flatten as the disease develops, until finally all growth ceases, and the weight curves become straight lines.

The age at which the young begin to develop signs of rickets, the rapidity with which the disease develops, and the severity of the final lesions depends more upon the diet of the mothers than upon the weight of the young when they are weaned; the largest and most resistant of the young from mothers on rachitic diets develop rickets at an earlier age, and in a more severe form, than the lightest weight young from mothers on a complete diet.

The type of rickets which develops in young that are kept on a uniform low calcium, low vitamine diet changes from the slow progress of the chronic type of this disease to the rapid development of the very acute types, as the vitamine and calcium content of the mothers' diets are progressively altered from the diets which are rich in both calcium and vitamine to those which are deficient in both of these factors.

The increasing readiness with which rickets attacks the spine in the young that are kept on the uniform rickets-producing diet is a fairly accurate index of the kind and amount of the calcium and vitamine deficiency in the mother's diet.

ADAIR AND PROSHEK.

Stockman, Ralph: The Action of Atropine on Milk Secretion. Edinburgh Medical Journal, 1927, xxxiv, 340.

It is ordinarily taught that preparations of belladonna suitably made up for direct application to the mamma are clinically very effective in arresting the secretion of milk.

As it is often necessary in practice to arrest milk secretion in women owing to intercurrent illness or for other reasons, it seemed desirable to settle the question definitely from the practitioner's point of view, and this could readily be done in a midwifery clinic. Fifty-two cases were treated, and the same procedure was followed in them all, 1/100 grain atropine sulphate being administered hypodermically morning and evening for the first seven days after delivery. No other treatment was given except in a few of the cases noted below.

Seventeen of the 52 were primiparae, all healthy young women with abundance of milk. In 15 of these the amount of milk formed after beginning the atropine was so small that it caused no discomfort and no further treatment was required; in one, the breasts became hard on the third day and a single dose of magnesium sulphate was given in addition; one began to nurse her child but it died on the second day. The breasts became hard on the fourth day of atropine administration, and a dose of magnesium sulphate was given after which no milk formed.

Thirty-five were multiparae, all of whom had a plentiful supply of milk, but nursing was avoided on account of debility, anemia, tuberculosis, nephritis, or death of the child. In 27 of these the secretion of milk was completely arrested; in 7 sufficient milk formed to cause discomfort and to require the administration of one or several doses of magnesium sulphate; in one an acute attack of pyelitis with high temperature supervened on the seventh day. Nursing was stopped and atropine given, but it failed to arrest milk secretion and the breasts had to be exhausted.

Our knowledge of the physiology of milk secretion and its relationship with the nervous system and certain of the endocrine glands is so unsatisfactory that it would be waste of time to indulge in what must be mere speculation regarding the mode and point of action of atropine in arresting it, but it seems certain that the commonly accepted view that atropine has the power to arrest milk secretion is correct.

WM. C. HENSKE.

Debuys: A Simple Dressing for the Breasts of Mothers of the Newly Born. American Journal of Diseases of Children, 1927, xxxiii, 841.

The author devised an adhesive plaster dressing (shown in photographs) which holds the breasts perpendicular to the chest wall and pointing directly towards front. They are supported in this position without being pressed down. There is no compression of the mammary glands, no obstruction to any of the ducts and no twisting of the nipples; hence the milk may be secreted without obstruction, and the natural leakage of the excess milk may take place in a normal way. It is most useful when applied about the fifth day and allowed to remain for about five days.

Fissured nipples, and caked or abscessed breasts have been rare with the use of this dressing.

S. E. PESETKE.

Irvin, Robert, R.: Caffeine in the Breast Milk of Coffee and Tea Drinkers. Medical Journal and Record, 1926, cxxiv, 37.

There was obtained constantly from the breast milk of coffee and tea drinking mothers a substance possessing the characteristics of caffeine. In crystalline shape, solubility in water and chloroform, and in its capacity to be sublimed, this substance is highly suggestive of caffeine, or possibly a derivative thereof. Since it was found only in traces in human milk its absolute identification was extremely difficult.

The caffeine-like crystals were found to be absent in the breast milk of a woman who drank no coffee, tea, or other alkaloid containing substances.

WM. C. HENSKE.

Frensdorf: Transmission of Luminal Through Milk. Münchener Medizinische Wochenschrift, 1926, lxxiii, 322.

It has been previously shown that such substances as iodine, salicylic acid, ether, mercury, salvarsan, and morphine when administered to the pregnant or nursing mother could be recovered in the mother's milk. The author reports a case of a patient, forty-six years of age, who in the ninth month of pregnancy, was seized with an epileptic fit. The patient was given 0.3 gm. of luminal in 3 doses in one day. There was no repetition of epileptic seizures. One week after the attack the patient was delivered of a normal apparently healthy female infant which cried lustily at birth. The infant was put to the breast at 3-hour intervals but after the second day it refused to nurse. The infant seemed to be in a state of "twilight sleep" for six days. This was suggestive of a cumulative effect of the luminal excretion. From the eighth day to the eleventh day on discharge the baby was again perfectly normal. By this time the luminal must have been completely excreted when the baby resumed its normal state.

As yet there is no literature as regards this drug with special reference to its excretion in breast milk.

W. B. SERBIN.

Schreiner: Shall the Child Nurse in the Presence of Mastitis? Zentralblatt für Gynäkologie, 1924, xlviii, 1015.

The question of treatment of the mastitis of nursing women, particularly whether at the beginning or during a mastitis the child should be nursed, is discussed by Schreiner on the basis of 151 cases of mastitis observed among 5,252 patients in Cassel. He concludes that at the first clinical appearance of mastitis nursing should be interrupted, and the breast placed absolutely at rest and treated with antiphlogistics. This gives satisfactory results in 90 per cent of cases, and the temporary removal of the child until the disappearance of inflammation is followed by permanent loss of secretion in only a very small percentage of cases.

LITTLE.

Schmidt: The Treatment of Commencing Mastitis With Local Injection of the Patient's Blood. Zentralblatt für Gynäkologie, 1925, xlix, 1893.

The writer adds to the accepted methods of treatment of early mastitis the injection of patient's blood to which has been added 3.8 per cent isotonic sodium citrate solution. The injection is made around and underneath the infiltrated area, 20 to 50 c.cm., according to the extent of the breast involvement. In five cases there was a rapid decrease in the size of this area, and healing without abscess formation, so that the mother was able to nurse in four or five days. The sixth

case was cured after two series of injections, but in a further five cases where only a small quantity of blood (10 c.cm.) was injected, incision and drainage unfortunately were necessary.

LITTLE.

Seitz, L.: The Treatment of Mastitis by Means of the Bardenheuer Incision. Monatschrift für Geburtshilfe und Gynäkologie, 1925, lxxi, 134.

The author recommends the use of the Bardenheuer incision for recurring mastitis with multiple abscesses, for deep-seated and retromammary abscesses and for diffuse phlegmonous inflammation over a great part of the breast. The incision is made as follows: An arc-shaped incision is made at the lower edge of the breast, thereby separating the gland tissue from the underlying tissue. The breast is lifted up, all abscesses are opened and gauze is inserted into the wound. Because of the position of the incision there is abundant drainage when the patient is in the horizontal position. When the scar heals it is entirely concealed by the overhanging breast. This incision was used by the author with success in seven cases.

J. P. GREENHILL.

Harttung: The Treatment of Mastitis With the Patient's Own Blood, the Bardenheuer Incision and Secondary Suture. Monatschrift für Geburtshilfe und Gynäkologie, 1927, lxxvi, 4.

In the early treatment of mastitis the author warmly recommends the intramuscular injection of the patient's own blood. The beneficial results are the same as those derived from protein therapy. Where incision of the breast is necessary, the type of incision which gives the best results in all cases is that of Bardenheuer at the lower edge of the breast. The after-treatment consists of the application of tampons saturated with 10 per cent sodium chloride solution. On top of these, compresses of normal salt solution are placed. The hypertonic saline solution must be made to saturate the entire wound. After the wound is clean, the edges are sutured without disturbing the granulation tissue.

J. P. GREENHILL.

Hartmann, Renaud, and d'Allaines: Pseudo-Neoplastic Tuberculosis of the Breast. Gynécologie et Obstétrique, 1924, x, 6.

Most writers have concerned themselves with consideration of disseminated or confluent forms of breast tuberculosis. There is another type which does not at all resemble tuberculosis to the naked eye and reveals its true character only on microscopic examination. The authors have had three cases of this form, called pseudo-neoplastic tuberculosis.

Case I., forty-nine years old, complained of a tumor of the breast. The first symptom noticed was a retraction of the nipple, later a very slow increase in volume of the indurated area, never particularly painful. Amputation of the breast with removal of the subjacent portion of the pectoralis major; axilla dissected. Patient made an uneventful recovery.

Pathology: On cut section of the tumor one sees a very voluminous mass of fibro-fatty material which is separate from the nipple. Immediately below the nipple there is a reddened area in the center of which is a small cavity containing greenish liquid. Microscopically there are glandular lobules filled with characteristic inflammatory lesions in the middle of which one finds occasionally typical follicular lesions of tuberculosis.

Two other similar cases are cited, in each of which operation was done for supposed carcinoma of the breast.

The authors stress the fact that the important picture microscopically is a diffuse inflammation of the breast, the lesions being in the *connective-tissue layer*. The gland itself seems little affected. Occasionally a proliferation of the acini occurs, giving the picture of adenomas.

This illness develops, in general, in healthy subjects. Rarely is any pulmonary tuberculosis demonstrable. The onset is insidious, with little or no pain. The tumor simply appears. Age incidence on twelve collected cases was thirty-five to sixty, thus corresponding with cancer. This form constitutes approximately 35 per cent of breast tuberculosis.

The most confusing thing about this type to the surgeon is that it almost invariably is adherent to the skin, which often takes on the appearance of an orange skin and is accompanied by retraction of the nipple. Axillary adenopathy is habitual but not particularly characteristic. The evolution is slow, simulating cancer. In one case there was a bloody discharge from the nipple and it was thought to be an intracanalicular epithelioma.

In the caseous forms or frankly suppurative forms cures can sometimes be effected by simple incision, followed by drainage with curative injections or curettages, but usually recourse is taken to amputation. In the pseudo-neoplastic form, amputation with axillary dissection seems the sole treatment which has been practiced up to date. The procedure is thus the same as for carcinoma, but it seems useless to make excisions of muscles and the operation ought to be more limited.

ADAIR AND PIERCE.

Books Received

GYNECOLOGY. By William P. Graves, Professor of Gynecology, Harvard Medical School. With 562 illustrations, 128 in colors. W. B. Saunders Company, Philadelphia, 1928.

HANDBUCH DER INNEREN SEKRETION. Herausgegeben von Dr. Max Hirsch. Verlag von Kurt Kabitzsch. Leipzig. Lieferungen 4, 5 und 6.

OBSTETRICAL NURSING. By Carolyn Conant van Blarcom, R. N. Second edition, revised. With 216 illustrations and 10 charts. The Macmillan Company, New York, 1928.

HORMONE UND INNERE SEKRETION. Von Privatdozent Dr. Fritz Laquer. Verlag von Theodor Steinkopff. Dresden. 1928.

STERILITY IN WOMEN. Diagnosis and treatment. By Sidney Forsdike, M.D., B.S. (London), surgeon to the hospital for women, Soho Square, London, etc., etc. With 24 illustrations including 17 plates. H. K. Lewis & Co., Ltd., London, 1928.

L'EXPLORATION RADIOLOGIQUE EN GYNÉCOLOGIE. Par Paul Béclère, professeur agrégé à la faculté de médecine de Paris. Masson et Cie, editeurs. Paris, 1928.

INTERNATIONAL CLINICS. Volume II, 38th Series, 1928. J. B. Lippincott Company, Philadelphia, 1928.

SALPNIGITIS ISTHMICA NODOSA. Von Dr. Franz Horalek, Bruenn. Verlag von F. Topic. Prag, 1928.

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FOLKLORE OF THE TEETH. By Leo Kanner, Yankton State Hospital, South Dakota. The Macmillan Company, New York, 1928.